

THE ELECTRICAL CONTRACTOR

The Magazine of
ELECTRICAL CONSTRUCTION AND MAINTENANCE

JUNE 1943

DIGEST OF MARITIME ELECTRICAL MAINTENANCE PRACTICE

An editorial feature section—on organization, priorities and
know-how of electrical maintenance, complete in this issue.



Electrical and marine work involve specialized knowledge and
interest. See "Power and Light for Sea and Land", Part 49

YOU CAN
BE SURE
OF YOUR

IC

"INTERRUPTING CAPACITY"

WHEN YOU BUY G-E UNIT SUBSTATIONS

The severity of a short circuit depends largely on the capacity of the substation that feeds the circuit, NOT on the normal load on the circuit. To assure you of *adequate* interrupting capacity for even the most severe short circuits, G-E

load-center unit substations are built with *properly rated* breakers. These are air circuit breakers which have been co-ordinated—electrically, mechanically, and thermally—with the capacity of the substation and the system.



G-E drawout air circuit breakers are properly rated—can be inspected quickly and safely—and need little maintenance throughout a long life.

FOR DEPENDABLE PERFORMANCE—

G-E air circuit breakers have positive-acting, dual-magnetic, overcurrent trips which provide time-delay protection for overloads (adjustable from 100 to 200 per cent of the breaker rating), and instantaneous protection from short circuits. Silver-to-silver contacts, fast-acting arc quenchers, and generous current-carrying elements assure reliable operation.

—AND EASY MAINTENANCE

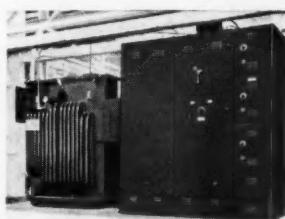
Drawout air circuit breakers, which roll in and out as easily as a file-cabinet drawer, can be inspected, tested, or replaced with another breaker quickly and safely. After a power interruption, a simple turn of the breaker handle quickly restores service. Air circuit breakers in your G-E unit substation assure an important saving in time and labor required for routine inspection and maintenance.

If you need dependable load-center unit

substations in a hurry, or simply want more complete information, get in touch with the nearest G-E office, or write to General Electric, Schenectady, N. Y.

FOR D-C, TOO—

RECTIFIER UNIT SUBSTATIONS



Now you can have direct-current power at your load centers by running high-voltage a-c all the way, and converting to d-c with rectifier unit substations located at those centers.

GENERAL  **ELECTRIC**

802-18-5900

Easy overhead SERVICING - without stops - in vital war work!



FAST SERVICING of indoor, high-overhead fluorescents, sprinkler heads or "what-have-you"—without stopping production, even where aisles are narrow—is accomplished with ease by reaching over bench or machine. Murray Crows' nests mounted on caster trailers or electric platform trucks are the last word in adaptiveness. Send for the convincing facts that have made this aerial ladder favorite among utilities for more than a decade. No obligation. Metropolitan Device Corporation, Brooklyn, New York.

INDOOR—OUTDOOR

Murray crows'nest

CASTER TRAILERS
ELECTRIC PLATFORM TRUCKS OR
STANDARD COMMERCIAL TRUCKS 1½ TON OR HEAVIER

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*Skillfully Designed
Ruggedly Built*

for
**MINIMUM
MAINTENANCE**

**HUNDREDS OF APPLETON TYPES TO
MEET EVERY CONDUIT FITTING AND
LIGHTING FIXTURE REQUIREMENT**

Appleton Conduit Fittings and Lighting Fixtures cut maintenance cost in two important ways—they're sturdily made to last as long as the building where installed, and those that may ever require any service are carefully designed for easy accessibility.

For instance, when an Appleton Explosion-Proof Fluorescent Lighting Fixture needs a new lamp, it's a simple matter to remove the screw cover and install one. Easy, low-cost maintenance was given important consideration by Appleton engineers when the design was still on the drawing boards.

Lower cost of installation, too, is characteristic of Appleton equipment—from simplest conduit fittings and lighting fixtures to big explosion-proof panel boards—types and sizes running into many thousands and blanketing every requirement. All are skillfully planned for quick hook-up and easy wiring.

You not only build for permanence with Appleton fittings and lighting fixtures, you also pave the way for long years of rock-bottom maintenance expense. That double advantage means lasting satisfaction and good-will on every job where you install Appleton equipment.

Sold Through Wholesalers

APPLETON ELECTRIC COMPANY

1704 WELLINGTON AVENUE

CHICAGO, ILLINOIS

Branch Offices: NEW YORK, 76 Ninth Avenue • DETROIT, 7310 Woodward Avenue • CLEVELAND, 1836 Euclid Avenue • SAN FRANCISCO, 655 Minna Street • ST. LOUIS, 420 Frisco Bldg. • LOS ANGELES, 100 North Santa Fe Avenue • ATLANTA, 175 Luckie Street, N. W. • BIRMINGHAM, 6 N. Twenty-first Street • MINNEAPOLIS, 305 Fifth Street, S. • PITTSBURGH, 418 Bessemer Bldg.

Resident Representatives: Baltimore, Boston, Cincinnati, Dallas, Denver, Kansas City, Milwaukee, New Haven, New Orleans, Philadelphia, Seattle



APPLETON

CONDUIT FITTINGS • OUTLET AND SWITCH BOXES • EXPLOSION-PROOF FITTINGS • REELITES

Electrical Contracting

WITH WHICH IS CONSOLIDATED THE ELECTRAGIST AND ELECTRICAL RECORD - ESTABLISHED 1901

A practical technical and management journal for electrical contractors, industrial electricians, inspectors, engineers and motor shops, covering engineering, installation, repairing, maintenance and management, in the field of electrical construction and maintenance.

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Power and Light for Shipbuilding 49

Electrical systems for welding, power and lighting to build vital war shipping involves elaborate interlocked distribution and practical flexibility.

Shop Conversion to War Work 52

How an Omaha electric motor repair shop transformed its machine shop into an efficient war production unit.

Simplified Office Methods 54

This Cincinnati motor serviceshop has adopted a simplified payroll system and a continuous invoicing method which has accelerated the clerical department output.

Ballast Design Advances 56

By C. STONEHILL—Advances in ballast design conserves materials in fluorescent lighting installations.

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Keep 'em both rolling

Does your business depend on your truck—a truck which you can't replace for the duration? Then remember this cheering fact:

The money you formerly set aside for depreciation and trade-in costs will be more than enough to keep your present truck rolling!

Use this money today for *Preventive Maintenance*. Give your truck regular and systematic inspection, adjustment and servicing. Get longer truck life, fewer road failures and, in the long run, lower costs per mile—just as the operators of large truck fleets have done for years.

It's easy for you to do this now. Until recently, *Preventive Maintenance* required elaborate records and was feasible only for large fleet operators. But today thousands of service stations and garages offer you a simple plan for one or more trucks and passen-

ger cars, based upon the proved methods of the big fleets.

The time for you to start *Preventive Maintenance* is now! It will be too late when your truck wears out or breaks down. Today, while your truck still rolls, put it in the care of a service station or garage near you—one that's equipped to give your truck regular and systematic *Preventive Maintenance*.

* * * * *

*Published in the interest of our national need for
truck conservation by*

ETHYL CORPORATION

Chrysler Building, New York City

*Manufacturer of Ethyl fluid, used by oil companies to improve
the antiknock quality of motor and aviation gasoline.*

Success Story!

'a Guide to Wartime Care of Electric Motors,' is the best publication of this sort we have ever seen.

—FROM A CHIEF ENGINEER

I handed it to the foreman of our shop. He took it home and today he has asked me for permission to shut down the machine shop and make a check on every motor we have in accordance with instructions in the book.

—PRESIDENT OF A LEADING MANUFACTURING COMPANY

These booklets have been sent to all our main plants and have met such an enthusiastic response on the part of the Superintendents that they have requested us to get one copy each for each of their receiving plants.

—A LEADING CANNER

This handbook has been read by most of our instructors, and the collective opinion in one word is "Excellent."

—FROM A NAVAL TRAINING STATION

These books have given us no end of information and helpful suggestions.

—AN AIRCRAFT MANUFACTURER

If you have not already sent this book to the other mills, please send me 14 more copies as I want to see that they get in the right hands for sure.

—ASS'T PURCHASING AGENT OF A LARGE SOUTHERN MANUFACTURER

NINE MONTHS AGO Allis-Chalmers offered free to U. S. industry a new kind of maintenance book ... "A Guide to Wartime Care of Electric Motors."

Setting up as targets for maintenance the 9 main enemies of motor life — dust, stray oil, moisture, friction, misalignment, vibration, uneven wear, overload, under-

load — this new handbook gave simple, easy-to-get, wartime directions for fighting them.

Result? Over 100,000 copies are already in use by the armed forces and war industry — and new requests pour in daily. If you haven't yet obtained your free copy, write ALLIS-CHALMERS, MILWAUKEE, WIS. A 1592

ALLIS-CHALMERS MOTORS

When you do need new motors, look into the strength, solidity and all-around protection of the new "Safety Circle"—protected top, sides, ends and bottom.

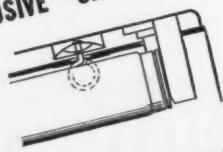
 WE WORK FOR VICTORY

WE PLAN FOR PEACE

SYLVANIA *proudly announces*



EXCLUSIVE "CAPTIVE LATCH"



This Sylvania-developed spring-type fastener saves installation and maintenance man-hours. It stays put while lamp is in service despite any kind of vibration. It locks or unlocks with a simple quarter turn. No tools are necessary.

MORE LIGHT FROM LESS WEIGHT

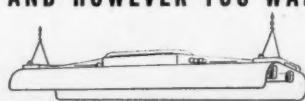
Sylvania pioneered composition reflectors for fluorescent fixtures and "proved them in industry."

This composition reflector has an efficiency of 86 per cent—even higher than that of prewar porcelain-enamelled metal in conventional contours.

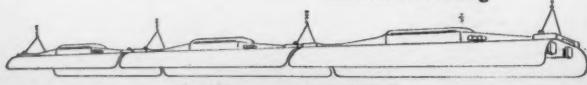
It is fabricated to Sylvania's specifications from a strong and durable composition. Coated with MIRACOAT inside and a handsome French Gray outside, it stands up under extreme humidity and temperature conditions. Also it is impervious to frequent washings.

It gives more light. It's lighter and easier to handle.

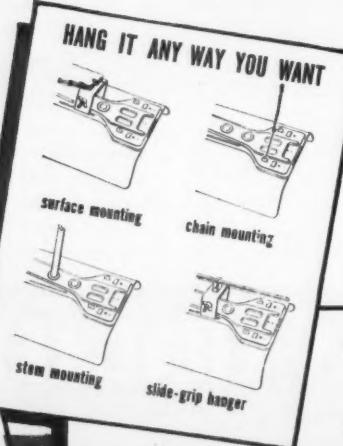
AND HOWEVER YOU WANT



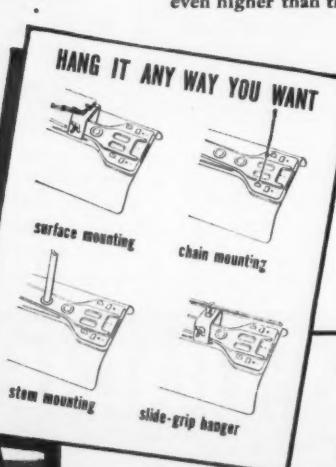
individual mounting



continuous row installation



HANG IT ANY WAY YOU WANT



THE FLUORESCENT FIXTURE *OF THE* FUTURE!



- EASIER INSTALLATION
- SPEEDIER MAINTENANCE
- SINGLE OR CONTINUOUS ROW INSTALLATION
- SIMPLE
- STANDARD
- REGULAR SIZE USES 2 OR 3 40-WATT LAMPS
- LARGE SIZE USES 2 100-WATT LAMPS

This adds up to a modern, standard, adaptable fluorescent fixture that eliminates installation headaches and stock troubles.

HERE'S what you've been hoping for—years ahead of time—a fluorescent fixture that has "everything"—the fixture of the future NOW.

Once again Sylvania engineers have taken another long step forward, and designed a unique industrial fixture without metallic reflector, with top-housing under three pounds. Their perfected design is a revelation of simplicity and adaptability.

This new Sylvania fixture is made in two sizes—for 100-watt and 40-watt lamps. In either length, one standard fixture will fill any industrial lighting requirement.

... Can be installed singly or in continuous rows.

... Can be stem-mounted, surface-mounted, mounted

with chains or slide-grip hangers.

... Can take either two or three lamps.

This one-for-all-purpose adaptability is attained by the streamlined top-housing that encloses the ballast, protects it and provides cooler performance. One-half-inch center knock-outs at centers of 18, 24, 30 and 36 inches provide for any type of mounting. The starter sockets are readily accessible, and there is a convenient knock-out for a pull-chain switch if desired.

This is the fluorescent fixture of the future that the trade has been waiting for. It meets all WPB requirements, carries Underwriters' Laboratories approval and our own standard guarantee. For specifications and prices, write Dept. X-00, Sylvania, Ipswich, Mass.

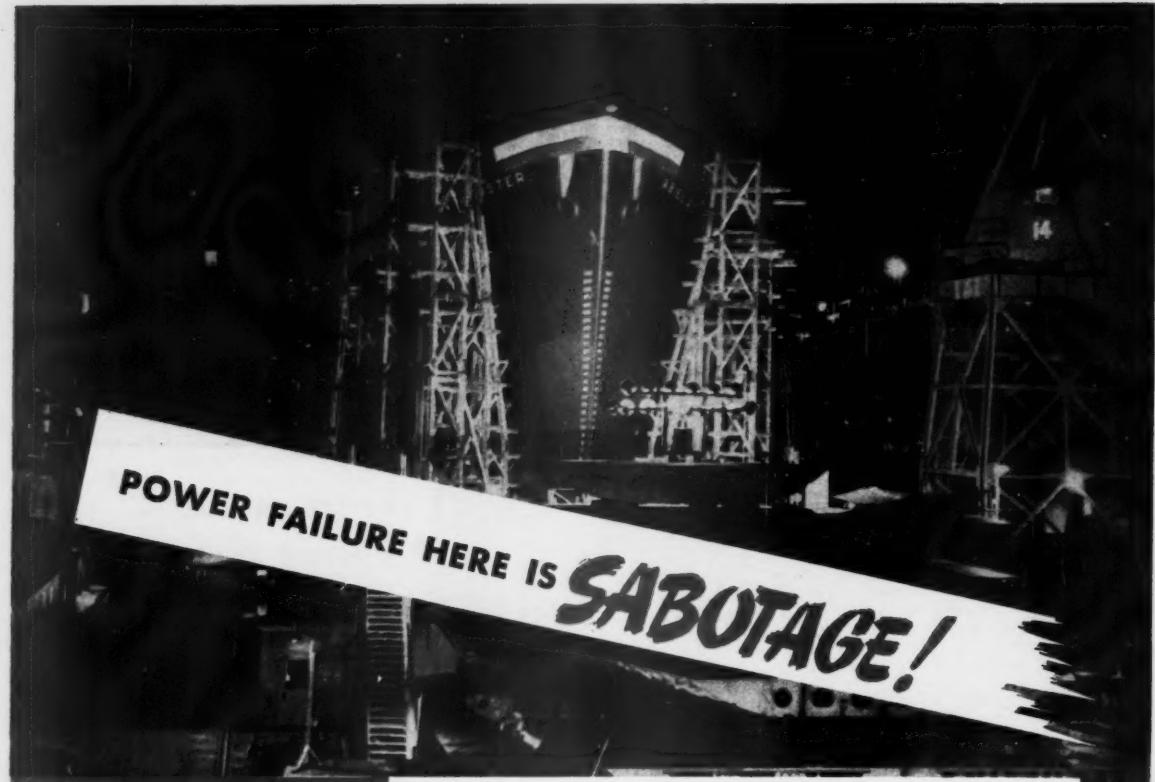
"Everything that's Finest in Fluorescent"

SYLVANIA

ELECTRIC PRODUCTS INC.

Fluorescent Fixtures Division, Ipswich, Mass.

INCANDESCENT LAMPS, FLUORESCENT LAMPS, FIXTURES
AND ACCESSORIES, RADIO TUBES, ELECTRONIC DEVICES



Guard Vital Circuits WITH **Central RIGID STEEL Conduit**



One after the other—American Liberty Ships slide into the sea. Vital circuits supplying production power must not be sabotaged by shock, vibration, twisting, or moisture.

CENTRAL'S consistent uniformity, accurate threading and easy workability speeds installations for shipbuilders and electrical contractors . . . wherever vital conduit goes.

SOLD BY

SPANG CHALFANT, Inc.

General Offices: GRANT BLDG., PITTSBURGH, PA.

District Offices and Sales Representatives in Principal Cities

NEW

TOTALLY ENCLOSED

TRI/CLAD MOTOR



**FULLY ARMORED AGAINST THE ENTRY OF
DESTRUCTIVE MATERIALS—RESISTANT
TO CORROSION AND EXTERNAL DAMAGE**

On this new member of the Tri-Clad motor family, end shields and frame are solid cast iron, smoothly contoured and tightly fitted. Ball bearings are protected by a rotating-labyrinth bearing seal—against damaging dusts or liquids. The leads are sealed in compound in a cast-iron pocket in the frame. Inside, the motor has all the extra-protection features of Tri-Clad open motors, such as Formex* wire.

An outstanding feature of these new motors is that their mounting dimensions are interchangeable with those of open motors of like rating.

For complete information on the totally enclosed Tri-Clad,

*Reg. U.S. Pat. Office

FRAME SIZES				
Hp	Rpm	Poly-phase	Single-phase	
1/2	900	204		
3/4	1200	203	204	
3/4	900	224		
1	1800	203	203	
1	1200	204		
1	900	225		
1 1/2	3600	203	203	
1 1/2	1800	204	204	
1 1/2	1200	224		
2	3600	204		
2	1800	224	204	

see your G-E representative, or write to General Electric Co., Schenectady, N. Y.

**FOR "CRUEL" SERVICE
CONDITIONS LIKE THESE**

(Meeting requirements of WPA
Motor Conservation Order L-291)

DESTRUCTIVE DUSTS*

Where rock dust, metal filings, powdered chemicals, or other finely divided materials are present in destructive quantities.

CORROSIVE FUMES*

Where motors are exposed to corrosive acids and alkalies in liquid or vapor form, such as on mixers in chemical pilot plants.

GUMMY, VISCOUS MATERIALS

In working with paints, oils, syrups, and other materials which might "gum up" the interior of an open motor.

SUPERSATURATED ATMOSPHERES

Where motors must operate without fail in areas filled with steam, water vapor, oil droplets. Also out of doors in humid, stormy climates.

* In addition to this standard totally enclosed Tri-Clad motor, G. E. can furnish explosion-proof types, tested and listed by Underwriters' Laboratories, Inc., for (1) hazardous dusts, such as magnesium dust, coal dust, grain dust, (2) hazardous fumes, such as gasoline.

GENERAL ELECTRIC

750-214-8080

PIERCE RENEWABLE FUSES

Give positive protection
for all electrical circuits

Keep production up...by
protecting circuits from
needless interruption

Because

Pierce Renewable Fuses, as shown by the diagram, are the only scientifically screen-vented, air-conditioned fuses, operating 10% to 50% cooler, eliminating excess heat and pressure.

Pierce Fuses are safer, stronger, and easier to renew, with the same vibrationless, reliable contact that is built into them at the factory.

Compare Pierce Fuses, part for part and design for design, with any other.

PIERCE RENEWABLE FUSES, INC.
211 HERTL AVENUE, BUFFALO, NEW YORK

Pierce Renewable Fuses, Inc.
Offices, Plant and Research
Laboratory. Home of Pierce
Air-Conditioned, Renewable
Fuses since 1941.



ELECTRICAL MAINTENANCE IS A 24-HOUR JOB

"Preventive Maintenance is of Prime Importance" — Electrical Contracting

Today's War industry Operations place heavy burdens on electrical systems. Therefore plant electrical staffs, motor service shops and industrial customers look to reliable fuse operation in their Preventive Maintenance duties.

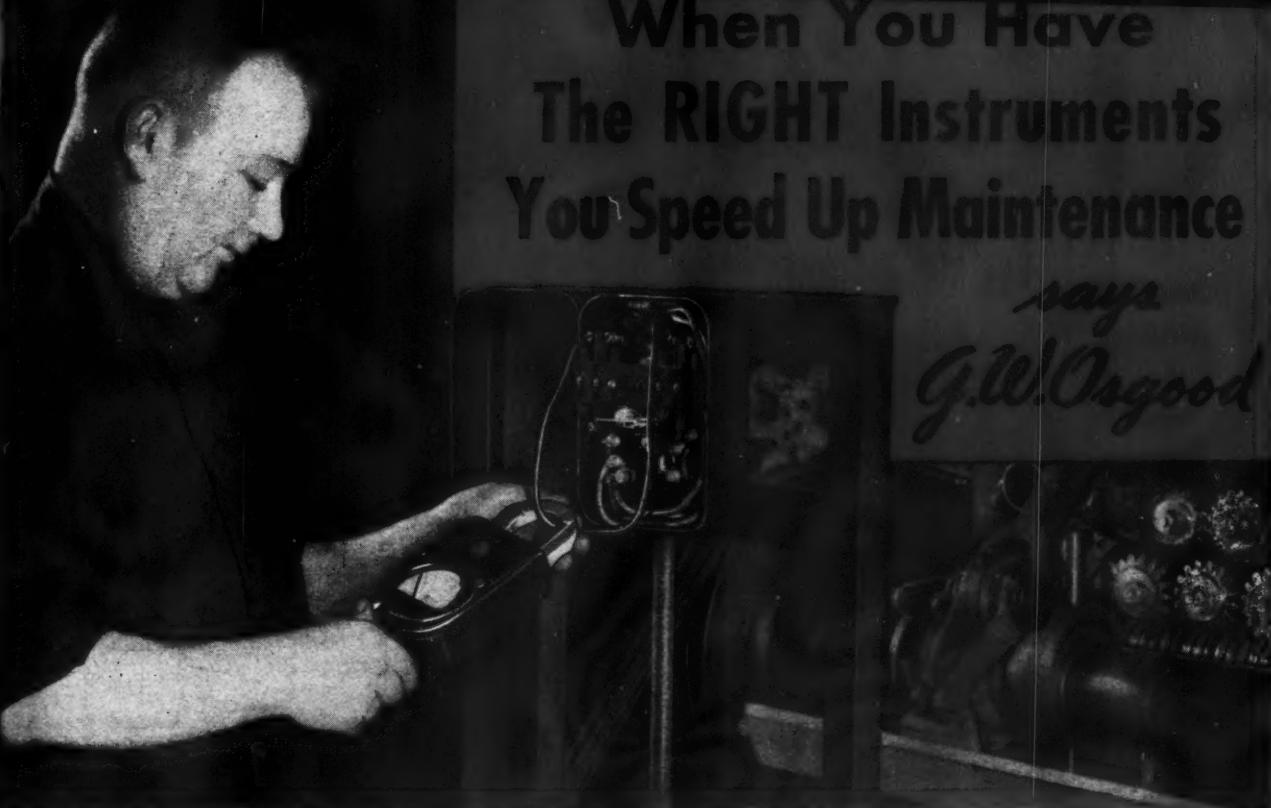
Pierce field engineers and Pierce distributors are available to help essential industries improve their maintenance conditions through proper applications of Pierce "Air Conditioned" Fuses. Call on them—get their story—they will cooperate with you to the utmost.

Electrical Contractors serving today's war industries—motor service organizations—industrial electrical staffs—all can benefit by getting full information regarding the Pierce "Air Conditioned" Fuse line. Call on the Pierce Field Engineer or your Pierce Distributor.

Pierce RENEWABLE Fuses

AIR CONDITIONED FOR LONGER LIFE

When You Have The **RIGHT** Instruments You Speed Up Maintenance



says
G.W.Osgood

WHICH OF THESE TESTING INSTRUMENTS DO YOU LACK?

AK-1

A-C HOOK-ON VOLT-AMMETER. The handiest of instruments for quick load checks—no cutting conductors or interrupting service. Measures volts also. Bulletin GEA-2950.

AP-9

MEDIUM-SIZE PORTABLE, A-C (AND DP-9, D-C). Accurate within $\frac{3}{4}$ of one per cent. Very portable—size only $2\frac{1}{2}$ by $4\frac{1}{2}$ by $6\frac{1}{2}$ inches. Price covers a 5-amp ammeter. Bulletin GEA-1784.

AS-5

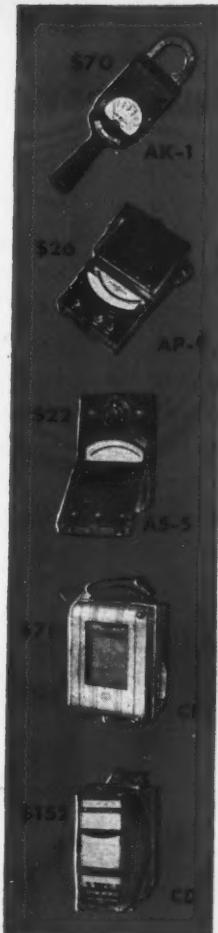
POCKET-SIZE PORTABLE, A-C (AND DS-5, D-C). Accurate within one per cent. Slips easily into a coat pocket—size 2 by $3\frac{1}{2}$ by $5\frac{1}{2}$ inches. Price covers a 5-amp ammeter. Bulletin GEA-1784.

CF

INKLESS RECORDER, PORTABLE. An inexpensive instrument. Inkless—no pen to start and no ink to spill. Price covers a 5/10-amp ammeter. Bulletin GEA-3187.

CD

INK RECORDER, PORTABLE AND SWITCHBOARD. Ideal for use where a high degree of accuracy is very important. Price covers a 5-amp portable ammeter. Bulletin GEA-1061.



"FOR QUICK LOAD CHECKS, we find the General Electric hook-on volt-ammeter the handiest of all instruments. But, it is not a cure-all. There are times when we use an indicating instrument that has an accuracy even higher than the ± 3 per cent of the AK-1.

"For still other work, we need a chart record of current or voltage taken during an entire cycle of operation of a single machine, or of an entire section of the plant—that's when we use a recorder.

"Having the *right* instruments available speeds up our preventive maintenance work."

Those are the words of G. W. Osgood, Electrical Department, Merrimac Hat Co., Amesbury, Mass.

Don't Handicap Green Hands by a Lack of Instruments

When experienced maintenance men like Mr. Osgood say it's important to have the *right* instruments, we can imagine how handicapped inexperienced men must be without them.

Still, you don't need a roomful of instruments. The five shown here will do 90 per cent of your testing work (prices are for estimating only). If you would like more information about them, ask the nearest G-E office for the bulletins listed. If these instruments won't answer, tell us what you need. We may have a standard instrument that will do the job: *General Electric, Schenectady, N. Y.*



The Army-Navy "E", for Excellence
in the manufacture of war equipment,
now flies over six G-E plants
employing 100,000 men and women.

GENERAL  **ELECTRIC**

GE-20-4200

TO THE E.E. WHO SAYS:

"We're having
a helluva time
with solder..."



BURNDY SAYS: *"Stop Worrying!"*

YOU DON'T NEED A DROP OF SOLDER TO MAKE A GOOD JOINT!"

3 from thousands

of Burndy Solderless Connectors



Hylug — Type YAG (indent type)



Servit — Type KS



Qiklug — Type QA-B

Burndy left the solder pot behind over 20 years ago—and the millions of sound Burndy solderless connectors since put in service under every conceivable operating condition prove what a great step forward this was!

For tiny wire connections, or for the largest conductor connections for heavy current loads, Burndy solderless connectors replace the messy, time-wasting solder pot with simple clamping elements

. . . providing SPEED and EASE and a BETTER ELECTRICAL CONNECTION.

Whatever connector problem may be bothering you today, Burndy has either solved it in 20 years of specialized engineering in this field—or will solve it for you now, with a connector custom-made to fit your needs. Call in a Burndy representative. If he can't show you time and cost savings decidedly worth-while, invite him to go fly a kite!

Burndy
*Headquarters for
connectors*

The Answer TO YOUR ELECTRICAL CONNECTION PROBLEM

OVERHEAD • UNDERGROUND • POWER • WIRING • GROUNDING

BURNDY ENGINEERING CO., INC. • 107 EASTERN BOULEVARD, NEW YORK CITY

G. E. Announces



They save pounds of critical material per fluorescent fixture

AS AN aid to fixture manufacturers in their programs to save critical materials, we now offer this addition to our line of war-plant ballasts. These ballasts differ from those of conventional design *only* in location of leads, which come out through two bushed holes in the base plate (one at each end).

Installation simplified. These new ballasts can be mounted completely exposed atop a narrow, shallow wiring channel just wide enough and deep enough to enclose the leads. The saving in iron and steel is therefore substantial, since there is no longer need to allow room for the complete ballast in the fixture itself.

Because of their exposed location, these ballasts will operate in lower ambient temperatures—which

BALLASTS WITH LEADS OUT the BOTTOM

contributes to long ballast life. They do not require special installation features, such as ventilating louvers and conduction plates.

Wide range of ratings. Ballasts with leads out the bottom are available in 40-watt Tulamp and three-lamp ratings, 100-watt Tulamp and Forlamp ratings—those used most in war plants.

For more details about this improved design, and for information on the rest of the G-E line of ballasts for fluorescent lighting, send for your copy of Bulletin GEA-3293. *General Electric, Schenectady, N. Y.*

GENERAL  ELECTRIC

"SEE-ABILITY"

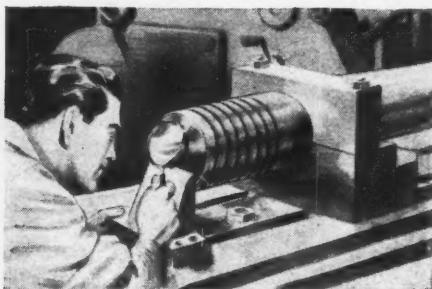


NOT ONLY MORE GUNS, but better guns, are coming out of the arsenals of democracy. Better workmanship, greater accuracy are possible because of better "See-ability" over the lathes, boring machines, drills, and inspection benches.

Through its knowledge of modern lighting, Westinghouse is contributing daily to improved "See-ability" in our war plants. Knowing that the heart of good lighting is the lamp, Westinghouse has steadily improved quality. Today Westinghouse fluorescent lamps are brighter than ever, and they stay bright from end to end.



builds better guns



ACCURACY IN testing, grinding, machining, assembling, and hundreds of other operations depend on "SEE-ABILITY."



JUST OFF THE PRESS! 32 page book, "SIGHT FOR VICTORY," prepared by National Better Light—Better Sight Bureau. Designed to be presented by lighting men to every war plant in America. Includes valuable check forms for comprehensive "SEE-ABILITY" analyses. Every lighting man should be familiar with this book.

IN MODERN GUNS accuracy is checked at every step in manufacture. "SEE-ABILITY" aids these close inspections.

Join the "Sight for Victory" Program

The National Better Light-Better Sight Bureau has pointed up the wartime objectives of the lighting industry, starting with a check-up of seeing conditions in war production factories. We can all help in this important task and make the check-up complete by July 4, 1943. "See-ability" is a must for good workmanship, accuracy, and increased production. Let's all do our part in the "Sight for Victory" program, help win the war faster, and then we can all have the opportunity we have been waiting for. Westinghouse Electric and Manufacturing Co., Bloomfield, New Jersey.

A black and white advertisement for Westinghouse Mazda Lamps. On the left, there are two circular lamp heads with the brand name "MAZDA" and "WESTINGHOUSE" embossed on them. To the right, a rectangular box contains the text "Westinghouse MAZDA LAMPS" in large, bold letters, followed by "FOR GREATER 'SEE-ABILITY'" in a smaller font. The background of the ad features a blurred image of a lamp.

CRESFLEX NON-METALLIC SHEATHED CABLE • SERVICE ENTRANCE CABLE • MAGNET WIRE • BARE WIRE



IN THIS TIME OF WAR

... Emerson-Electric is dedicating its 53 years of experience entirely to the job of supplying our armed forces with weapons that will help win the war.

But, even in these grim days, Emerson-Electric fully recognizes its responsibility to its customers, to its employees, to the men and women now engaged in military service.

This advertising program for 1943 is designed to enable Emerson-Electric to carry out its responsibilities, after Victory, and to do its part in maintaining the American way of living which we are now fighting to preserve.

By maintaining the interest and confidence of the consuming public with a broad program of national advertising, Emerson-Electric is providing its Wholesalers and Retailers with the most substantial assurance that their Emerson-Electric franchise will continue to be a valuable business asset, after "Victory".

Emerson-Electric fans, motors, welders and other products of the past 53 years are old reliable friends to millions of people. Since they cannot buy Emerson-Electric products

now, these folks deserve to know how extensively Emerson-Electric is participating in the war effort. New friends and customers will also become favorably acquainted with Emerson-Electric products through this program. If you desire a copy of Folder 655, giving complete information, write today.

THE EMERSON ELECTRIC MANUFACTURING COMPANY
SAINT LOUIS • Branches: New York • Detroit • Chicago
Los Angeles • Davenport

EMERSON ELECTRIC

MOTORS • FANS • APPLIANCES • AIR CONDITIONERS • AIR FLOW WELDERS

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VARNISHED CAMBRIC • RUBBER POWER CABLES • BUILDING WIRE • RADIO WIRES • SIGNAL CABLE • FLEXIBLE CORDS • LEAD-ENCASED AND PARKWAY CABLES • ARMORED CABLE

Some of The

CRESCE

N ELECTRICAL WIRES AND CABLES

That Are Meeting To-day's Special Needs

For war housing, industrial wiring and interior wiring of all kinds.



"CRESFLEX" Non-Metallic Sheathed Cable

Extensively used in shipyards, and for the manufacture of tanks, guns and planes.



Welding Cable

For portable power leads to drills, tools, welding and construction machinery.



"PERMACORD" Heavy Duty Portable Cable

For electric power and control circuits aboard ship.



Shipboard Cable

For general industrial power wiring. Widely used because no rubber required in construction, and can carry larger currents for same size copper conductors.



Varnished Cambric Power Cable

CRESCENT INSULATED WIRE & CABLE CO.

ASK YOUR JOBBER FOR



CRESCE

N WIRES and CABLE

Factory: TRENTON, N. J.—Stocks in Principal Cities

CRESCE

NT ENDURITE SUPER-AGING INSULATION • WEATHER-PROOF WIRE



This 48-page data manual published recently by the General Electric Company furnishes all of the information necessary for the design and installation of electrical systems in Robertson Q-Floors. The cellular structure of these modern Q-Floors makes possible electrical flexibility and adequacy undreamed of before—a definite advantage for building owners, architects and electrical contractors.

For further information about G-E Q-Floor Wiring and how it can be used to insure adequate electrical wiring, get in touch with your nearest G-E Merchandise Distributor.

* * *

Q-Floor literature will be gladly furnished by Robertson engineers. Contact the nearest Robertson office (in all principal cities).

Electrical Maintenance Men

Q-Floors offer you complete electrical availability and adaptability for all maintenance requirements, rearrangements and changes in War Production Plants.

Think what it would mean to you to have capacious, approved electrical raceways every six inches throughout your entire floor system . . . just beneath the floor surface! What we really make is Maintenance Time.

H. H. ROBERTSON COMPANY • Farmers Bank Building • Pittsburgh, Pa.

ROBERTSON Q-FLOORS

What's Behind the Trade Mark?



Faith in the Future

The Youngstown Sheet and Tube Company was founded in November, 1900 by 47 local investors, with an authorized capitalization of \$600,000. In December, 1901, this capitalization had been increased to \$4,000,000 to provide for the expanded program decided upon by the men of vision who planned the future of this company.

In February, 1902, 14 months after the initial meeting of the shareholders of this company, the first product carrying the Youngstown trademark was produced. In this same year, these pioneers took the first step to assure complete integration . . . the first producing blast furnace was purchased... the first ore properties were acquired... and the first coal lands obtained. These early acquisitions all served as a nucleus around which was created the great industrial organization, which in later years served mankind in every corner of the globe where products of civilization were making life more complete.

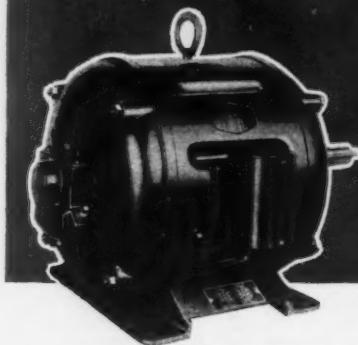
We are doubly appreciative of the efforts of those who preceded us at Youngstown. These men of faith, courage, foresight and action have bequeathed to us those things with which we can make a definite contribution in helping to win freedom for the world today, and upon which we can help build an assured prosperity for the future.

Pipe and Tubular Products - Sheets
Plates - Conduit - Bars - Tin Plate
Rods - Wire - Nails - Tie Plates and
Spikes - Alloy and Yoloy Steels

**The YOUNGSTOWN
SHEET AND TUBE COMPANY, Youngstown, Ohio**
Manufacturers of
CARBON • ALLOY AND YOLY STEELS



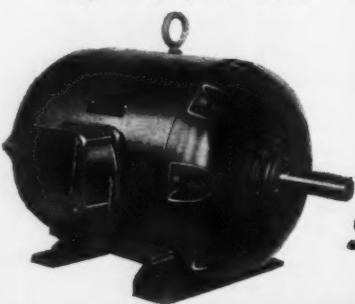
IN TIME OF WAR AND IN TIME OF PEACE...



Wagner type RP Squirrel-Cage Motors are used on machine tools and other electrically-driven equipment that operate in clean, dry locations. 1/6 to 400-hp, 25 to 60 cycle, 2- or 3-phase.



Wagner type CP Totally-Enclosed Fan-Cooled Motors are used on machine tools and other motor-driven equipment, where dust, dirt, filings, chips, fumes and other destructive elements are prevalent. 1-1/2 to 125 hp, 25 to 60 cycle, 2- or 3-phase.



Wagner type HP Explosion-Proof Motors are ideal for machines located where inflammable materials and substances are handled or manufactured. 3/4 to 125 hp, 2- or 3-phase, 25 to 60 cycle.

M43-11

MOTORS

THE skill and facilities Wagner has gained in 52 years of manufacturing quality motors are now being used to speed up Victory. Wherever there is war activity you will find Wagner motors doing a job — on ships, tanks, and planes...in army cantonments and navy yards...on motor driven machinery and equipment in shipyards, in mines and in all kinds of plants producing war materials.

Wagner motors have proved their ability to produce dependable power under the most severe operating conditions and they can help you, too, in your war effort.

No matter what type of motor you require — regardless of the torque, speed, or current requirements, you can choose a motor from the Wagner line that is correctly engineered for the job. The three motors illustrated represent just a few of the various types of Wagner motors. Each Wagner motor has special electrical and mechanical characteristics that make it the ideal motor for certain applications.

Wagner's 29 branches are manned by trained field engineers competent to solve your motor application problems. They will gladly consult with you and do everything possible to assure you the quickest delivery on the motors you need to keep war production on schedule.

Send for These Valuable Bulletins... Bulletins MU-182 and MU-183 illustrate and describe the complete line of Wagner motors — a motor for every purpose. Copies of these bulletins will be sent upon request.

Wagner Electric Corporation

ESTABLISHED 1891

6413 Plymouth Avenue, St. Louis, Mo., U. S. A.

ELECTRICAL AND AUTOMOTIVE PRODUCTS



This label means help for him..and help for you



IF YOU NEED new fluorescent lighting for your war plant, naturally you want to select it carefully—give it the same close scrutiny that you give to the product you turn out. But perhaps you haven't time. That's where fixtures bearing the FLEUR-O-LIER label come in.



THAT LABEL on a fixture tells you that any further test or check is unnecessary. Because FLEUR-O-LIER fixtures have been tested by impartial experts—Electrical Testing Laboratories, Inc., of New York, and CERTIFIED by them as meeting 50 rigid specifications set up by MAZDA Lamp makers to assure you dependable lighting.

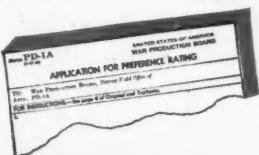


OVER 40 leading fixture makers throughout the country participate in this FLEUR-O-LIER specification program. So wherever your plant is located, there

is probably one or more of these FLEUR-O-LIER MANUFACTURERS near you to supply Certified fixtures that protect you and the worker who uses them.



EVERY INDIVIDUAL part of a FLEUR-O-LIER fixture is tested and Certified—as well as the assembled unit. Starters and ballasts, vital control parts, also meet exacting standards and carry their own E.T.L. labels.



FLEUR-O-LIER FIXTURES using non-critical materials are now available. Non-ferrous reflectors are covered by the same rigid

specifications as the former steel reflectors; have high reflection factor, sturdiness, safety, light weight; are built to Bureau of Standards design. And they give you the same dependable service as always. They can be obtained by war plants on suitable WPB priorities.



NEW! So that you may have full information about FLEUR-O-LIER specifications, a booklet including complete engineering data has been prepared for your guidance. Written by lighting experts, this booklet will be a valuable addition to your file on industrial lighting. With it you also get the full story of the FLEUR-O-LIER program and list of manufacturers. Write NOW to FLEUR-O-LIER MANUFACTURERS, 2122-6 Keith Building, Cleveland, Ohio.

FLEUR-O-LIERS

CERTIFIED FIXTURES FOR FLUORESCENT LIGHTING

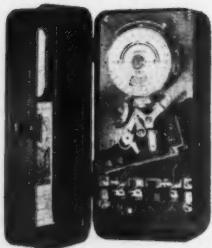
Participation in the FLEUR-O-LIER MANUFACTURERS' program is open to any manufacturer who complies with FLEUR-O-LIER requirements

FULL FLOODLIGHT Protection . . .

FROM
Sundown
TO
Sunrise with
AUTOMATIC
CONTROL



SANGAMO TIME-SWITCHES { AN IMMEDIATE ANSWER FOR
DEPENDABLE AUTOMATIC CONTROL



- Current interruptions up to 10 hours will not stop Form VSWZ astronomic dial time switch nor affect its "on" and "off" settings.



Catalog describes all types . . . tells about ease of installation—range of application and dependable construction.

SANGAMO ELECTRIC COMPANY SPRINGFIELD ILLINOIS

COPPER MUST STILL BE CONSERVED



For supplementary close-up lighting of machine tools, presses and other machinery, both lamp and transformer may be mounted on the machine.

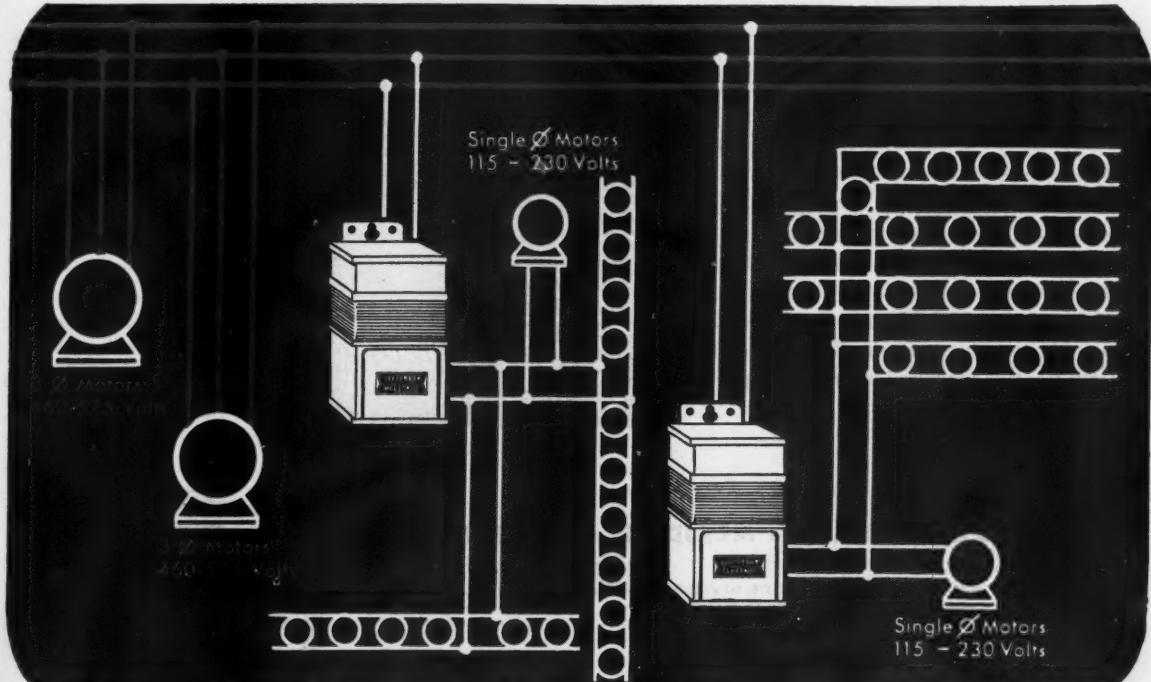
Power-Circuit Transformers eliminate need for separate Complete High Voltage and Low Voltage Circuits

Both engineering practice and copper conservation requirements dictate the use of only one main distribution of the higher voltage power current while providing for the lower voltage for lighting and small appliance purposes through the use of step-down transformers where current of this voltage is required.

Duplication throughout the plant or building is eliminated and the amount of copper effectively reduced. As the sketch shows—Jefferson Electric Power Circuit Transformers placed at intervals provide the necessary 115-230 volt current by stepping down from the power distribution. These transformers are the dry type and may be mounted on walls, posts or directly on machines . . . Bulletin 421-PCT contains complete data,—write for a copy... JEFFERSON ELECTRIC COMPANY, Bellwood, (Suburb of Chicago) Illinois. Canadian Factory: 60-64 Osler Avenue, W. Toronto, Ontario.



TRANSFORMERS POWER CIRCUIT

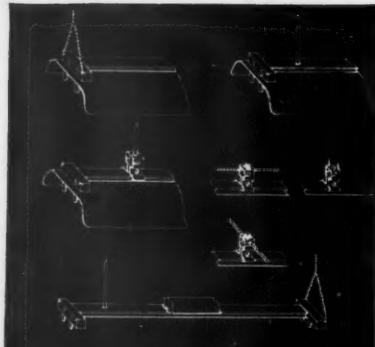




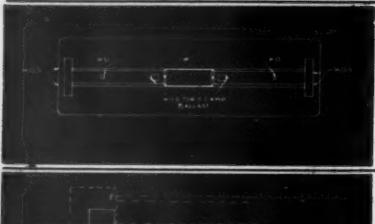
**MILLER does
it again...with
AERO-DESIGNED
FLUORESCENT
LIGHTING!**

AERO-DESIGNED fluorescent lighting is MILLER's answer to recent WPB regulations limiting the total amount of steel in fluorescent fixtures. To war plants, badly in need of more modern, productive lighting, it means in effect MILLER 50 Foot CANDLER and 100 Foot CANDLER fluorescent lighting systems are still available without any sacrifice of lighting efficiency, economy of installation, ease of maintenance, mobility or rugged construction.

Read carefully, please, the principal features of this new **AERO-DESIGNED** lighting as listed at the right. Then sit down and write MILLER at Meriden for full information . . . or call in our nearest field engineer (located in principal cities) for a specific discussion of how you can use this modern lighting to help busy war plants.



FLANGED TOP of channel permits clamp strap attachment at various points along channel, for ceiling, rod or cable mounting to suit any ceiling structure. Also can be suspended with chains, conduit or combinations of these methods.



WIRING CHANNELS, now streamlined, contain all necessary wiring and auxiliaries—with ballasts exposed for heat dissipation. Can be used as individual lighting units or in continuous rows.



MILLER SAFETY SOCKETS with integral safety lock to prevent lamps from falling are rigidly spaced and substantially mounted.



REFLECTORS are of Masonite with durable IVANITE, the "sealed-in-surface" finish for high reflection factor. Lightweight, easy to remove, simple to clean. Reflectors are "extra length" for good shielding of lamp ends. Miller reinforcing reflector attachment strap assembly is an integral part of each reflector—no change required for either two or three-light units.



FIXTURES carry both Underwriters' and RLM Standards labels—are backed by written warranty and MILLER'S almost 100 years of lighting experience.

THE MILLER COMPANY • MERIDEN, CONNECTICUT

ILLUMINATING DIVISION
Fluorescent, Incandescent
Mercury Lighting Equipment

OIL GOODS DIVISION
Domestic Oil Burners
and Liquid Fuel Devices

ROLLING MILL DIVISION
Phosphor Bronze and Brass
in Sheets, Strips and Rolls

WAR CONTRACTS DIVISION
War Materiel



ONE ANSWER

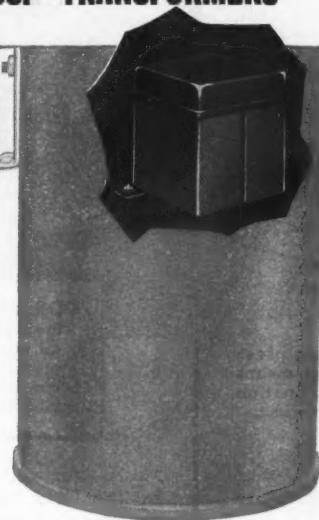
1 How can heavier loads be handled?

2 How can this equipment be protected against loss?

3 How can service interruptions be reduced?

TO 3 QUESTIONS ABOUT TRANSFORMERS

LOADING BY COPPER TEMPERATURE (L.C.T.) WITH CSP TRANSFORMERS



The answer to these questions is based on this fact: Loading by Copper Temperature (L.C.T.) increases usable transformer kv-a by 25% to 40% —with complete safety!

1 L.C.T. puts the reserve thermal capacity of a transformer to work. Emergency overloads can be carried longer, without danger, right up to the thermal limit of the windings.

2 L.C.T. gives sure protection against burnouts—positively disconnects a dangerous overload before windings can be damaged.

3 L.C.T. provides a visible indication of dangerous overload conditions so that load can be arranged, if necessary, to avoid power "blackouts."

Ask your Westinghouse engineer to give you the facts about this transformer development. He'll be glad to submit definite recommendations . . . glad to help you get more out of your transformer applications. Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., Dept. 7-N.

J-70398

TRIPLE ACTION

FOR PROTECTING TRANSFORMERS



MEASURES the amount of overload. Loading by Copper Temperature uses *actual* winding temperature, takes into consideration load duration and magnitude.



SIGNALS approach of thermal capacity. Unnecessary interruptions of service are avoided because a red warning light flashes when dangerous winding temperature is being approached.



DISCONNECTS load from transformer. If overload actually becomes dangerous, an internal circuit breaker *automatically* removes the load from the transformer.



Westinghouse

PLANTS IN 25 CITIES ... OFFICES EVERYWHERE

CSP TRANSFORMERS



Manpower Saved

**MORE
PRODUCTION-QUICKER**

Baking-Drying-Dehydrating or Preheating



FOR EXAMPLE—A prominent switch manufacturer discovered that the Near Infrared Process permits one worker to paint, bake and pack as many switch boxes as formerly produced by 4 workers with a previous method. The amazing speed, utility and savings of Infrared has been applied to hundreds of varying operations. Case studies applicable to your production are available on request.

Manpower and man-hours — a vital problem today — are being greatly conserved by the Near Infrared Process. This amazingly fast method of heat transfer cuts processing time in many cases from hours to minutes for baking, drying, dehydrating and preheating — reduces many product handling operations — requires no skilled labor — cuts manpower and man-hour needs substantially. The utilization of Fostoria Near Infrared equipment is low in both initial investment and operating cost. It is quickly and easily installed and can be moved readily. High flexibility provides adjustment to accommodate varying uses and shapes and sizes of products.

Throughout war industry, today, the rapid employment of the Near Infrared Process proves its remarkable advantages. It offers a probable solution to your particular production problem.

THE FOSTORIA PRESSED STEEL CORPORATION, FOSTORIA, OHIO
In Canada — Write Amalgamated Electric Corp., Ltd., Toronto

**Call Your Fostoria Industrial Service Center
FOR PRETESTING AND RECOMMENDATIONS**

Fostoria Industrial Service Centers, located in principal cities, are properly equipped and well qualified to solve your baking, drying, dehydrating or preheating problem. If their practical tests prove the Near Infrared Process to be a logical solution, the proper equipment to do the job is recommended. The service provides installation supervision and stands by to help the user obtain and maintain forecasted results.



NOW available

HAZAPAK RUBBERLESS WIRE

*a New
BUILDING WIRE
That Conserves
Critical Materials!*

HAZAPAK Rubberless Building Wire, approved by the Underwriter's Laboratories, Inc., is now available for use as a building wire for lighting and power circuits. Its insulation and protective coverings contain no critical war materials.

HAZAPAK Rubberless Building Wire conductors are first insulated with a sealed layer of Kodapak synthetic tape over which is wrapped a further protective covering of moisture-proof, crumpled kraft paper. This insulation (full N.E.C. thickness), is then covered with a Dilec flame and moisture-resisting wrap. It consists of a cotton wrap with full coverage of cotton threads wound on spirally with several threads wound on in the opposite direction, binding the cotton tightly to the wire and forming a smooth, fully-covering sheath slightly smaller in diameter and smoother than a braid.

HAZAPAK Type EG Building Wire is approved as the neutral grounded conductor in common AC circuits and as the "white" conductor in cable assemblies such as Hazardex, armored cable, twin lead encased, etc., where the W.P.B. Rubber Restriction Order prohibits the use of rubber insulation on the white or grounded neutral conductor.

HAZAPAK Type EI Building Wire is approved for single conductor in open wiring as a wartime alternate for rubber-insulated wire, and as the "hot" wire in non-metallic sheathed cable that is run exposed in dry locations. It is available in any of the standard building wire colors.



The use of Types EG and EI HAZAPAK Rubberless Wire is covered by Interim Amendments Nos. 44 and 69 to the 1940 National Electrical Code.

Consult our nearest office for details about this new type building wire or ask your wholesaler about HAZAPAK.



HAZARD INSULATED WIRE WORKS

Division of The Okenite Co.
WILKES-BARRE, PA. Offices in Principal Cities.

HAZARD Electrical Wires and Cables

Salvage Your Scrap — Buy U. S. War Bonds

3324

What has LIGHT to do with a B.A.R.?



PLenty. There are a lot of parts in a Browning Automatic Rifle—slide and piston, bolt link, ejector, firing pin, bipod, sere, . . . They've all got to fit so well and fire so fast that they deliver the goods at *560 rounds a minute!*

Some gun! Some parts!

Peacetime systems of industrial lighting are wholly inadequate for round-the-clock production of precision parts like these. War work efficiency demands something better—a flood of non-glaring, non-tiring, shadowless light. In two words—Cold Cathode.

But Cold Cathode is only as good as its transformers. Therefore, leading illumination engineers specify **SOLA COLD CATHODE LIGHTING TRANSFORMERS**. Sola transformers are a sturdy safeguard against low-voltage flicker or overload failure at some critical moment. They're an assurance of trouble-free operation.

Every significant improvement in luminous tube transformers during the past twelve years has originated in Sola laboratories. Find out what this record can mean to you. Send for bulletin **JLT-96**.

Cold Cathode Lighting Transformers

Transformers for Constant Voltage • Cold Cathode Lighting • Mercury Lamps • Series Lighting • Fluorescent Lighting • X-Ray Equipment • Luminous Tube Signs
Oil Burner Ignition • Radio • Power • Controls • Signal Systems • Door Bells and Chimes • etc. **SOLA ELECTRIC CO., 2525 Clybourn Ave., Chicago, Ill.**

HOW TO HELP "keep 'em firing" in your ELECTRICAL CONTROL army



It is DOUBLY important now to have some person in your plant definitely responsible for constant watch over electrical control apparatus. First, because the war effort must go on—without serious production delays. Second, because critical materials must be preserved—they are increasingly hard to replace. These fundamental inspection and maintenance pointers are available in printed card form. Write us for a supply. Post them where they may be useful.

INSPECTION

- 1. OVERLOAD?** Check present installations to make sure increasing demands have not stepped up loads beyond the danger point.
- 2. PROTECTED?** Check condition of fuses—heaters—circuit breakers. Make sure ratings are correct for present load carried.
- 3. WEAR?** Check individual switch and control units for condition of contacts, wear of parts, freedom from dust and dirt.
- 4. SAFETY?** Check condition of switch and control boxes—make sure interlocking safety devices are in operation and are being properly used. Replace faulty gaskets (on gasketed type enclosures). Be sure that the equipment is adequate to handle the requirements of the job.
- 5. OVERHEATING?** Check location and load conditions of apparatus. Relocate where excessive ambient temperatures may cause trouble.

Be sure the circuit is dead before working on current carrying parts.

NOTE: TRUMBULL apparatus is readily inspectable and, to a large extent, parts are replaceable *from the front*. Details of design make inspection and maintenance easier.

MAINTENANCE

- 1. OPERATE ALL SWITCHES AND CONTROLS PERIODICALLY.** Allow none to become "forgotten".
- 2. CLEAN or "BLOW OFF"** all apparatus—especially that in dusty or hazardous locations.
- 3. LUBRICATE REGULARLY** and carefully, to prevent friction and wear and tear—do not over-lubricate.
- 4. REPLACE (promptly) PARTS** that may be worn or imperfect—a minor part replaced may save major trouble.
- 5. CHECK WIRING CONNECTIONS FOR TIGHTNESS** at all points of contact—terminal lugs, fuse contacts, etc. Keep screws tight.
- 6. CLEAN CONTACTS** in accordance with instructions on inside covers and check for burning, pitting, and for proper alignment.
- 7. TEST** handles, crossbars, blades, for correct engagement, alignment and operation.
- 8. PAINT** boxes, conduits, etc. periodically to prevent rust or corrosion.
- 9. TAKE CARE** of your maintenance before repairs are necessary.



NOTE: Careful attention and inspection should be given to all electrical equipment, especially under war conditions where strain is severe and uninterrupted operation a vital necessity.

THE TRUMBULL ELECTRIC MANUFACTURING COMPANY • PLAINVILLE, CONN. • A GENERAL ELECTRIC ORGANIZATION
OTHER FACTORIES AT NORWOOD (CINN.) O.—SEATTLE—SAN FRANCISCO—LOS ANGELES

To educate that new man . . .



Got a **green man** on your hands? Worried because he isn't too well-acquainted with the hundreds of electrical items you use in your business, and with the folks who make them? Like to educate him fast and well — make him worth his salt for requisitioning and specifying? Your copy of the new 1943 E-B-R (Electrical Buyers Reference) can help so much . . . with its 592 pages of compact data on thousands of things electrical, including 369 pages of BRIEFALOGS*, its useful supplementary material, its valuable cross-indexing. Let that new man start using it today, and watch him turn into an expert on what is made, and who makes it.

* E-B-R's own original version
of modern condensed cataloging.

IF IT'S ELECTRICAL ... LOOK IT UP FIRST IN **E-B-R**

Now more complete than ever before, your 1943 Electrical Buyers Reference gives you:

MANUFACTURERS BRIEFALOG SECTION — Condensed catalogs of 290 manufacturers. Product specifications, branch offices, warehouses, etc.

CLASSIFIED DIRECTORY — Company addresses and trade names, arranged by product. Extensive cross-references to help you find the electrical and allied products made by more than 3,500 manufacturers.

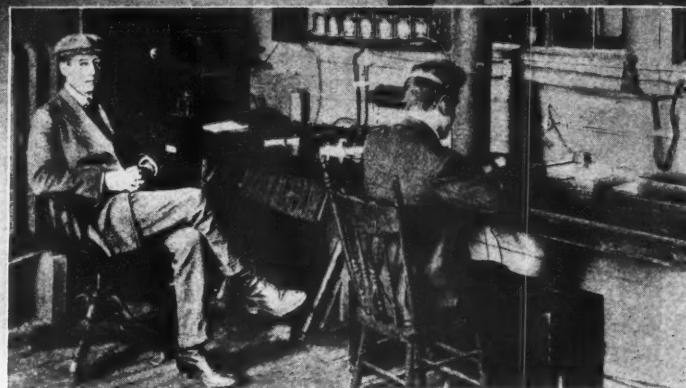
INDEX OF TRADE & COMPANY NAMES — Complete with addresses. Starting with only a trade name or a company name, you can thus quickly locate the product data you need.

A WORD OF EXPLANATION — E-B-R is not sold, and is not offered as a premium for subscriptions to any magazine. It is distributed to a limited number of men directly responsible for the specifying or requisitioning of substantial amounts of electrical materials.



MCGRAW-HILL PUBLISHING COMPANY, 330 W. 42nd ST., NEW YORK, N. Y.

AMERTRAN helped Marconi send his first message across the Atlantic!



ONE of Marconi's headaches in the earlier development of long distance wireless communication was the lack of suitable transformers. It is, therefore, significant that he chose transformers manufactured by the AMERICAN TRANSFORMER COMPANY for the Nova Scotia station that sent his famous first message. Then only one year old, this Company had already acquired a reputation for solving the most difficult transformer problems. This is only one of the many historic applications of electric power in which AMERTRAN has been a participant.

Today, startling improvements are being incorporated in our products as a result of field reports of war service from the poles to the tropics. Many years of experience are being compressed into a few months. Details regarding these new economies, new characteristics, higher efficiencies with war-born ruggedness and ease of installation, will be revealed when peace comes. Meanwhile, the full production of our factories is being devoted to the war effort.

AMERICAN
TRANSFORMER COMPANY
178 EMMET STREET • NEWARK, N. J.



PIONEER MANUFACTURER OF
TRANSFORMERS, REACTORS AND RECTIFIERS
FOR ELECTRONICS AND POWER TRANSMISSION

Electrical Contracting, June 1943

AMERTRAN

When You Can't Buy 'em **BIG**-Buy 'em **GOOD!**



REALLY, it's no hardship when you have to buy smaller motors. *You save money.* But remember, when you can't buy 'em big—buy 'em good.

Now that you cannot depend on oversize to take your motors through tough service—you must depend on quality.

That is why you should investigate Fairbanks-Morse Motors with *Copperspun* Rotors.

The winding of the *Copperspun* Rotor is centrifugally cast of COPPER in one piece. It provides electrical and thermal characteristics that give this motor the stamina to stand up under the most severe service without mechanical failure. You can operate a Fairbanks-Morse Motor with *Copperspun* Rotor at its full rated capacity continuously and indefinitely without fear of damage from overloading.

Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago, Ill.

Copperspun

FAIRBANKS-MORSE



DIESEL ENGINES
PUMPS
ELECTRICAL MACHINERY
SCALES
MOTORS

WATER SYSTEMS
FARM EQUIPMENT
STOKERS
AIR CONDITIONERS
RAILROAD EQUIPMENT

Motors

What do you do when a motor quits?



Well, frankly, you're in a jam.

You should, of course, take care of motors *before* they quit, by giving them the *little* maintenance so necessary to keep them on the job.



For example, let's consider Small Motors . . . those tiny, work-till-they-drop fellows who run your pumps, fans, appliances, and so forth. How long has it been since you gave them a little care?

It's so easy to keep your Small Motors in A-1 shape, happy at their job. Just be on the alert for their common enemies . . . friction, dust, moisture, vibration, overheating, noise.



3 Reasons Why We Must Make Electrical Equipment Last Longer

The more we save critical materials and the faster we produce, the sooner these birds will get it in the neck. Here's a book that's a real help. It's the new 100-page Westinghouse "Wartime Conservation" Book. Full of wartime information, it contains recommendations to save critical materials when selecting, applying, or using electrical apparatus. Write (company letter-head, please) for your copy. Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., Dept. 7-N.



If your Small Motor is already suffering from "ill-motor health", diagnose the symptoms and get it running again. Probably it's only suffering from a very common ailment.



We have just prepared a new Small Motor Maintenance booklet. It tells you how to protect your motors from their enemies, what to do when they attack. This new booklet is so chock-full of sound information that you will value it from the very moment you receive it.



For example, what would you do if your Small Motor failed to start? There are 13 possible "reasons why" and this new booklet tells what to do about each. You'll find it easy to understand; profusely illustrated; complete with maintenance details.



Keep those Small Motors on the job—our country needs them! Let us send a free copy of this booklet for each maintenance man in your factory or shop. No obligation. Just tell us how many you need. Ask for B-3215. Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa., Dept. 7-N.

J-90473



Westinghouse
PLANTS IN 25 CITIES... OFFICES EVERYWHERE
small motors

BURKE ELECTRIC COMPANY ERIE, PENNA., U. S. A.

Over 50 Years Old



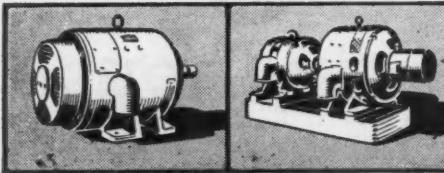
To old timers in electric power generation the name BURKE will bring back the memory of Jim Burke, close friend of Edison, Brush, Steinmetz and the electric leaders of his day. They will recall that Burke originated the Universal Motor, pioneered in refinements to 3-wire D.C. generation, and pioneered in the use of welded steel motor frames. They will recall perhaps that Burke developed the High-cycle Generator set and designed and built the first hand-operated portable generator set for the U.S. Signal Corps.

The same old nameplates that marked new Burke Generators and Motors many years ago shine forth on many 25-year and older Burke units today—proof that Burke-built is well-built.

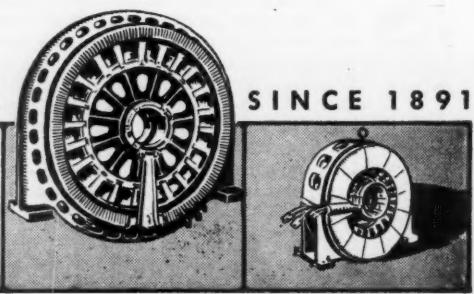
Today practically every type of battle or maritime ship afloat uses modern Burke motor generator equipment and thousands of Burke hand-operated generators help the Signal Corps on every front.

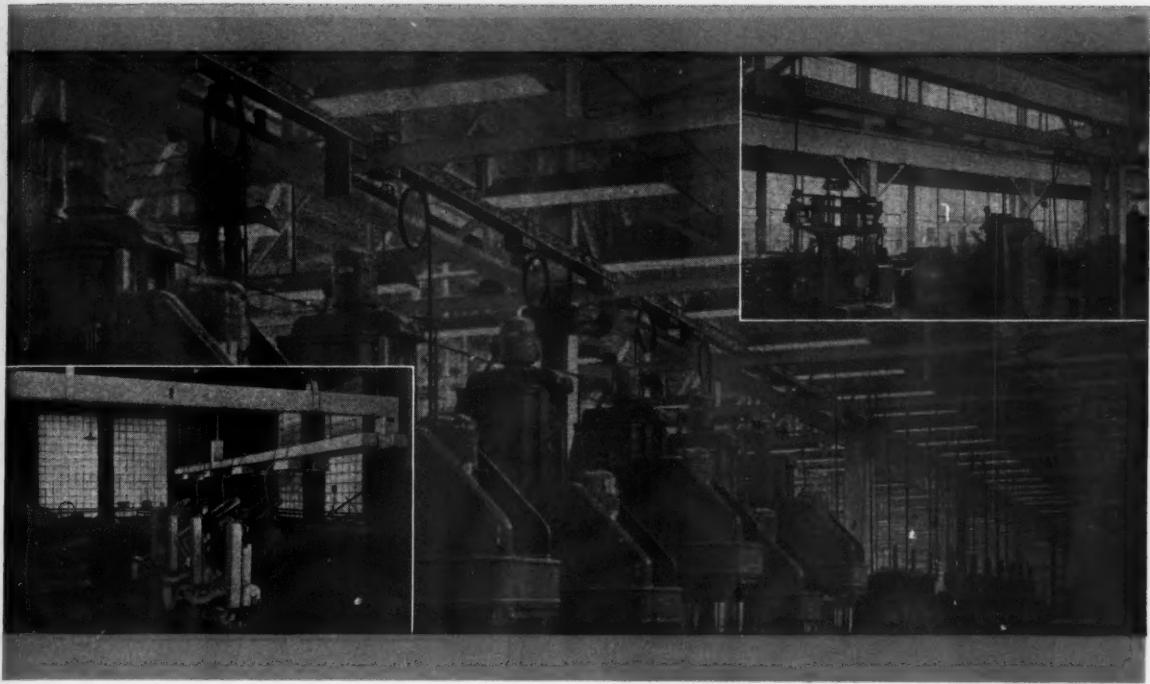
Write for the general Burke Booklet at the left, to get acquainted with a fine, reliable name in electric equipment.

BURKE ELECTRIC COMPANY • ERIE, PA.



D. C. Equipment to 1500 H.P.
and 1000 K.W.
A. C. Equipment to 1500 H.P.
and 1000 K.W.
M-G Sets to 1000 K.W.
Molded Bakelite Terminal
Blocks





Ease the Man-power Problem with **BUSDUCT**

The time saved when machines are moved to new positions means labor saved. Connections are quickly made to the conveniently placed outlets—and the machine is in service again with a minimum loss of production time . . . ® Busduct provides a complete duct system of distribution for light, heat and power. It forms a very flexible distribution system. Standard sections are 10 feet long. These, with pull boxes, elbows, end closures, tees and crosses, make it possible to fit any desired arrangement . . . Many plants engaged in war production are speeded up through the use of ® Busduct. Some of these plants are large—some small. Some are of new construction—some have been revamped and modernized. ® Busduct system fits all types with equal facility. It is the *modern* method for the distribution of current . . . Both Feeder and Plugin ® Busduct may be installed with minimum labor cost, and may be taken down and moved to new locations without appreciable loss of material . . . Designed for 2, 3 and 4 wire feeder systems; 25 volts DC, 575 volts AC, maximum. Plugin type capacities, 125 to 1,000 amperes; Feeder type, 250 amperes and up. Fully approved by Underwriters' Laboratories, Inc.

Use the Experience of the ® Sales-Engineer

in planning and designing an efficient and convenient ® Busduct distribution system. No obligation, of course. Write for name and address of the one nearest you. Bulletin 65 gives details . . . It will be sent promptly on request . . . Frank Adam Electric Co., St. Louis, Mo.



P.S.: On special order, "Conservation Type" ® Busduct, using a minimum of critical copper and steel, to meet W. P. B. requirements, is available.

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**War-Plant Lighting with
Metal-Saving Curtis Units**

Effective illumination for the great majority of war plant lighting and relighting projects can best be provided by utilizing either industrial type fluorescent fixtures or silvered glass reflector units for large wattage incandescent or mercury lamps.

Curtis Lighting now carries both of these types in stock and is in a position to provide the quick delivery necessary to secure jobs.

No. 589-T illustrated is typical of "X-Ray" Silver Mirror Reflector Industrial Units. Characterized by efficiency, permanence and ease of maintenance, these units are available for incandescent lamps up to 1500 watts and for the 400-watt Mercury lamp. Write us today for full information.

No. 1606-C illustrated is typical of the new Curtis light-weight fluorescent industrial units. Available for two or three 40-watt lamps or for two 100-watt lamps. These units may be used individually or in continuous lines. Installed either with chains as illustrated or by means of sliding clamp hangers which clamp to the wireway at any point between the ballasts and sockets.

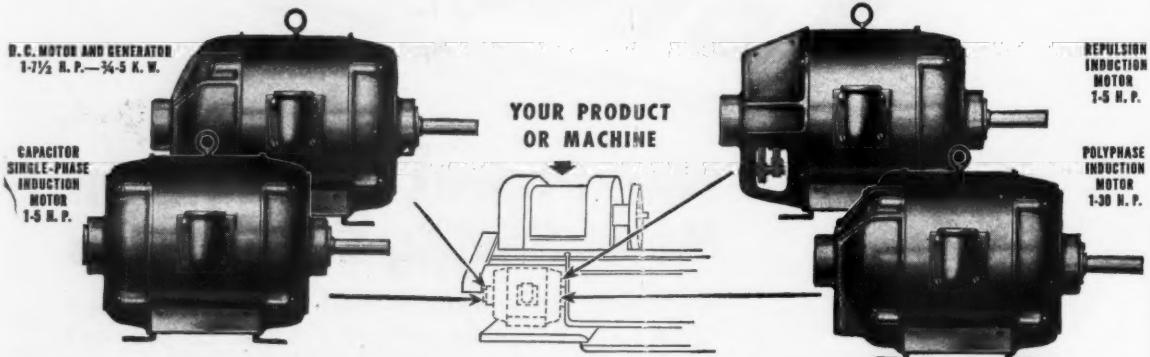
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Look! You can
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R&M Uni-Shell
MOTORS
INSTANTLY!

They're the only complete motor line in which all types in any one frame size are interchangeable and similar in appearance!

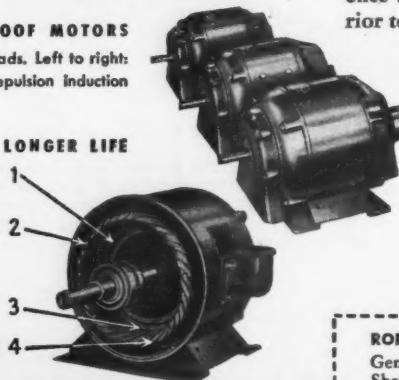


Whether you manufacture motor-driven products or just use motors on the production machines in your shop, you can readily see the tremendous advantage that R & M Uni-Shell Motors offer you in *complete interchangeability*. No longer need you redesign or rebuild machines to take different types of motors, for where one type of Uni-Shell Motor can be mounted, so can *any* in the same frame size! Shell dimensions, shaft-head fit, bolt circle holes, base, shaft size and conduit box mountings are identical for all.

DRIP-PROOF, SPLASH-PROOF MOTORS
have covers added, or special heads. Left to right: polyphase, direct current, and repulsion induction motors with covers.

BETTER INSULATION FOR LONGER LIFE

1. Two layers of highest-grade impregnated rag paper. 2. Wire coated with double-weight synthetic resin for strength and flexibility. 3. Added sheet of impregnated paper placed between coils in slot. Improved method used for holding end coils. 4. Entire winding assembly given several baked coats of synthetic resin-base varnish and covered with moisture-resistant synthetic resin and tung-oil sealer.



In the 30-month development and testing period R & M engineers worked out many *other* improvements, too, that make Uni-Shell Motors the most efficient, dependable and durable in R & M's 50 years of motor building. For complete protection, they're built in shells of steel. Better bearings and better balancing assure unusually smooth, trouble-free operation. New insulating techniques, together with the finest materials obtainable, increase motor life. And we have utilized our broad fan-building experience to make ventilation better than ever, keeping interior temperatures *below* guaranteed maximums.

20-PAGE BOOKLET TELLS THE WHOLE STORY

All of the many advantages and features of R & M Uni-Shell Motors are fully described and illustrated in a 20-page booklet just off the press. To get yours promptly, fill in the coupon below and mail it today.

Mail This Coupon Today!

ROBBINS & MYERS, INC., Springfield, Ohio

Gentlemen: Please send me your new 20-page booklet on Uni-Shell Motors.

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Company.....

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City..... State.....

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ROBBINS & MYERS • INC.

MOTOR DIVISION, SPRINGFIELD, OHIO

HOISTS & CRANES • MACHINE DRIVES • FANS • MOYNO PUMPS • FOUNDED 1878

hot and bothered?



Here is inexpensive war-time insurance to forestall big and little shutdowns caused by wire trouble.

Keep on hand this T & B emergency assortment of Maintenance and Repair Pressure (solderless) Fittings.

A mere handful—32—will lug, connect, tee and parallel tap all your wire sizes up to 500 MCM. A screw driver or key wrench does the trick.

These T & B fittings have been engineered to replace literally hundreds of various and sundry styles and sizes. Being mechanical, they install fast. Being T & B quality, they stay fast. Approved by Underwriters Laboratories.

Order this emergency material from our stocking T & B Distributors (our sole channel of distribution) and use your factory's Priority Rating—thus helping to keep your War Production schedules clicking on time.

HERE ARE THE BASIC 32

LOCKTITE LUG 7 take ALL cable sizes #4 to 1,000,000 CM.	HINJON JUNIOR 12 tap ALL mains #8 to 1,000,000 CM to all branches #14 to #1. Solid or stranded.
LOCKTITE TAP 6 tap ALL mains 1/0 to 500,000 CM to all branches #2 to 500,000 CM.	LOCKTITE 2-WAY 7 make ALL splices #4 to 1,000,000 CM.

Our Distributors stand ready to make up special assortments for your special needs.

Write us for folder, "Quick Help" on your Maintenance and Repair Jobs.

THE THOMAS & BETTS CO.

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MANUFACTURERS OF ELECTRICAL FITTINGS SINCE 1899

ELIZABETH, NEW JERSEY

In Canada: Thomas & Betts Ltd. Montreal





Making it hot for Hitler

ONE of Hitler's greatest headaches is America's vast steel production—this year more by far than that of all the Axis countries combined.

The "hot seat" for Adolph is being made especially hot by America's great electric furnaces . . . for they produce the fine alloy steels that make the vital parts of our planes, guns, and ships just enough better to spell the Axis' doom.

These vitally important furnaces depend upon electric current—current which must be delivered unfailingly night and day. Only electrical wires and cables of the finest quality,

of the utmost dependability, can be entrusted to this job.

We are proud that products of American Steel & Wire Company play such an important role in delivering power and light to America's vast war production machine. The quality of our electrical wires and cables is no accident. For years and years our engineering and production departments have worked for constant improvement.

And they continue to work on new ideas and developments to take care of the increased wartime demands for power and light and the ultimate conversion to peacetime requirements.



AMERICAN STEEL & WIRE COMPANY

Cleveland, Chicago  and New York

Columbia Steel Company, San Francisco, Pacific Coast Distributors

United States Steel Export Company, New York

UNITED STATES STEEL

MARTIN-GIBSON announces



THE NEW
5000 LINE

**Sensational new FLEXI-COUPLER
brings new economy . . . new flexibility
to continuous-run installations!**

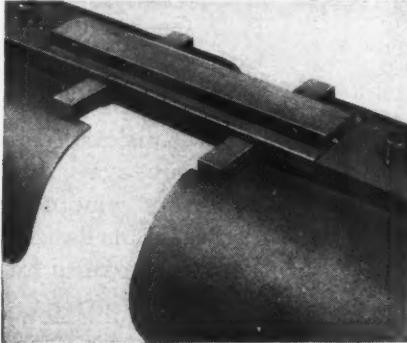
If you supply war plants you'll see in a minute why these new MARTIN-GIBSON 5000's give them all they'll ever need in fluorescent lighting . . . and more.

Meeting all government steel-limitation orders, this revolutionary 5000 Line sacrifices nothing in strength and rigidity, and it adds . . . the FLEXI-COUPLER!

ECONOMICAL — FLEXIBLE — PRACTICAL

The FLEXI-COUPLER is an exclusive MARTIN-GIBSON development that simplifies continuous-run installations, and brings unusual flexibility of length to such jobs. It permits variable spacing between each individual unit in a continuous-run to fit work needs, yet preserves the continuous wireway features and appearance. It makes possible the exact tailoring of an installation to the dimensional restrictions of any area . . . the only continuous-run lighting that will stretch out or in to meet individual conditions.

For instance: In a 50-foot run, using 100-watt units, the FLEXI-COUPLER makes it possible to do a swell job with 10% fewer fixtures, saving 10% cost and using 10% less current!



FLEXI-COUPLER permits spacing of units as much as 6" apart—yet preserves all features of a continuous-run.

HIGH REFLECTION FACTOR!

Non-metallic reflectors on the M-G 5000's are processed by the exclusive MARTIN-GIBSON "Permaline" method, which gives an unusually high reflection factor of 89% to 91%. And the "Permaline" method preserves an exceptional degree of straightness and uniformity. Reflectors are easily and quickly removable from the channel by means of a simple fitting that requires no tools.

M-G 5000's come equipped with $\frac{1}{2}$ " knockouts for pipe suspension or conduits. And you can get new adjustable slide hangers that make it easy to solve the problems created by trusses, girders, etc.

M-G 5000's can be obtained with necessary WPB priorities. Early orders will permit delivery starting approximately July 1st. Write NOW for full information.

We sell through wholesalers exclusively! If Martin-Gibson Luminaires are not already wholesaled in your community, write us. You will like our broad, fair policies.

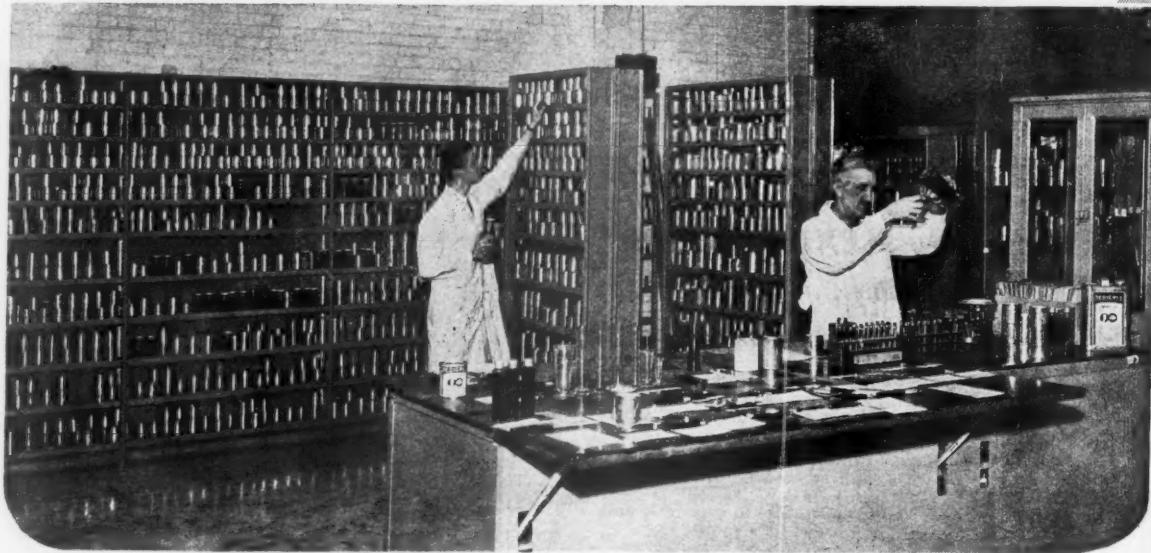
MARTIN-GIBSON CO.

999 HARPER AVENUE

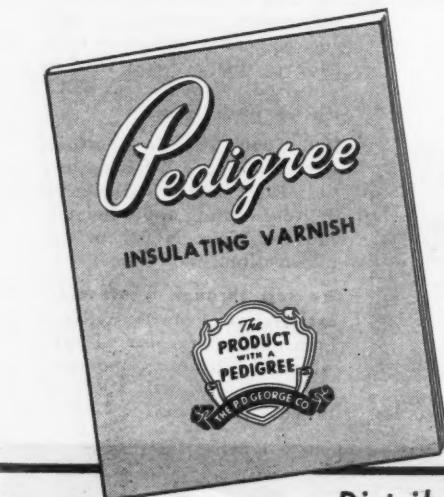
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QUALITY CONTROL

of All Pedigree Varnishes
Assures Uniform Tough Insulation



Pedigree Varnishes are checked during each stage of manufacture to verify rigid adherence to exact formulae.



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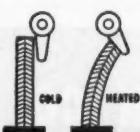
no pits... no burns... no errors!



Harmful overloads are doomed to defeat when electrical circuits are protected with Westinghouse "De-ion" Circuit Breakers.

Momentary overloads are passed without interruption; but before any disturbance can become dangerous, the sensitive Bi-metal element goes to work, *quick!* The circuit's broken, the arc quenched, in the blink of an eye.

Contact points are protected against severe pits and burns. The "De-ion" arc quencher draws the arc into the chamber, divides and smothers it in half a cycle. Contacts last longer; require less maintenance. And service is just as easily restored.



"IN THERE PITCHING" is this Westinghouse Bi-metal element. Two metals which react differently under heat are bonded together. Threatening overloads cause this Bi-metal to bend, tripping the interrupting mechanism, opening the circuit.

Once the condition causing the disturbance has been corrected, a simple flip of the indicating handle restores the circuit . . . in seconds. No waiting for a maintenance man; no parts to repair or replace.

Protect equipment and circuits with Westinghouse "De-ion" Circuit Breakers. Ratings up to 600 amperes; enclosures for practically every type of service. Get in touch with your local Westinghouse representative today. Westinghouse Elec. & Mfg. Co., E. Pgh., Pa., Dept. 7-N.

J-21276

Westinghouse
PLANTS IN 25 CITIES... OFFICES EVERYWHERE



"DE-ION" CIRCUIT BREAKERS



CATCHING THE "HOT ONES" is the job of this "De-ion" arc quencher. Made of parallel metal plates in the form of a grid, it draws the arc into the chamber, divides it into segments and smothers it between the plates . . . all in the space of half a cycle.

MEET THE
D E M A N D
 WITH
ILLINOIS
 COMPLETELY INSULATED
 ALL PORCELAIN WIRING SYSTEMS . . .

PORCELAIN CONFORMS
 TO THE NATIONAL ELECTRICAL CODE



TOGGLE SWITCH PLATE



Look for this
 Trade Mark



OUTLET BOXES AND COVERS



STANDARD TUBES



STANDARD KNOBS



SWITCH BOXES AND COVERS



DUPLEX RECEPTACLE COVER

CLEATS

★ Contractors everywhere know that Porcelain in large quantities is available —that, therefore, they can do wiring jobs today with no let down in wiring quality —that they still can assure customers of permanency, dependability, and economy—that simplified modern installations are the result of the use of All Porcelain Wiring Systems.

This all means continued business for you —wiring goes right along —porcelain products are in demand. So, as those calls come to you for porcelain, be sure you are prepared with ILLINOIS PORCELAIN.

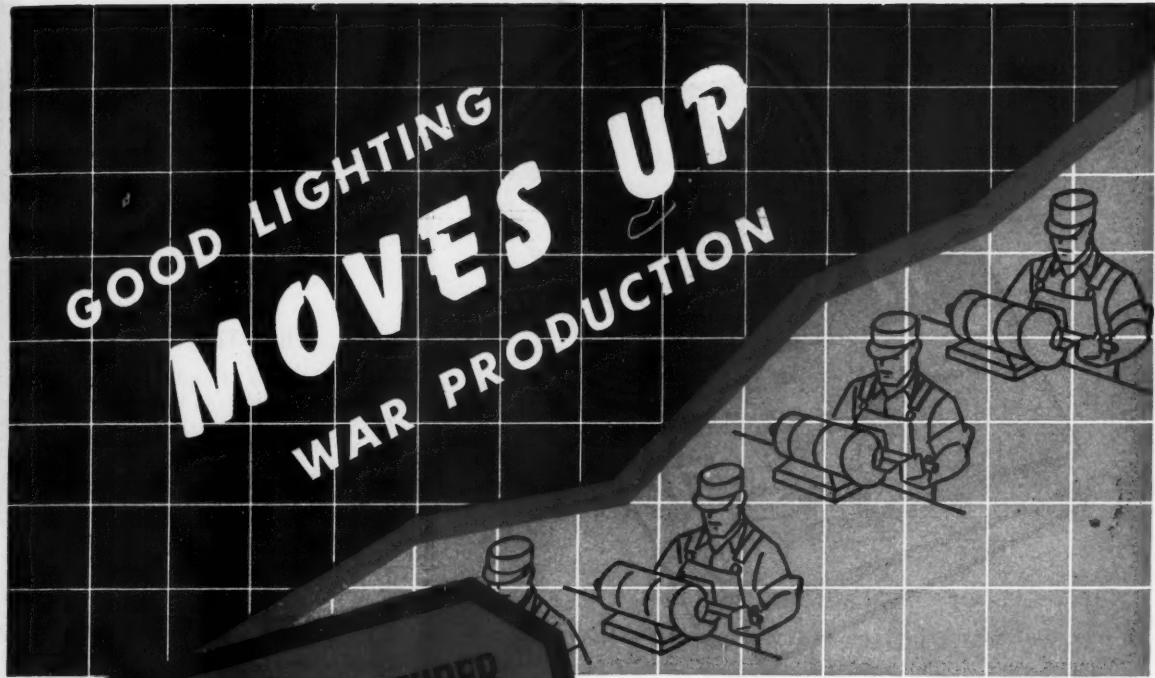
No vital materials go into the production of porcelain, materials do go into porcelain that make these systems durable—that are not affected by rust or corrosion —that make possible full safety —that make these systems valuable where there is dampness and fire hazard.

Illinois all porcelain wiring system are adaptable to practically all wiring plans and layouts. They can be installed without grounding.

Illinois

ELECTRIC PORCELAIN CO.

MACOMB, ILLINOIS



Manufacturers of RLM Certified Industrial Lighting Units

ABOLITE REFLECTOR COMPANY West Lafayette, Ohio	OVERBACH AND AYRES MFG. CO. Chicago, Ill.
BENJAMIN ELECTRIC MFG. CO. Des Plaines, Ill.	QUADRANGLE MFG. COMPANY Chicago, Ill.
BRIGHT LIGHT REFLECTOR CO. Brooklyn, N.Y.	SMOOT HOLMAN COMPANY Inglewood, California
DAY-BRITE LIGHTING, INC. St. Louis, Mo.	WESTINGHOUSE ELECTRIC AND MFG. CO. Cleveland, Ohio
GOODRICH ELECTRIC COMPANY Chicago, Ill.	WHEELER REFLECTOR CO. Boston, Massachusetts
THE MILLER COMPANY Meriden, Connecticut	

*"PLANT EFFICIENCY," issued by the War Production Board's Division of Information urges good plant lighting as a practical means for securing:

(1) Increased Production; (2) Better Workmanship; (3) Continued Production by Older Employees; (4) Less Eyestrain; (5) Reduction of Accidents; (6) Better Morale; (7) Better Housekeeping.

The Letter RLM Stand for Reflector and Lighting Equipment Manufacturers

RLM STANDARDS INSTITUTE
INCORPORATED

307 NORTH MICHIGAN AVE., SUITE 1600 • CHICAGO, ILL.

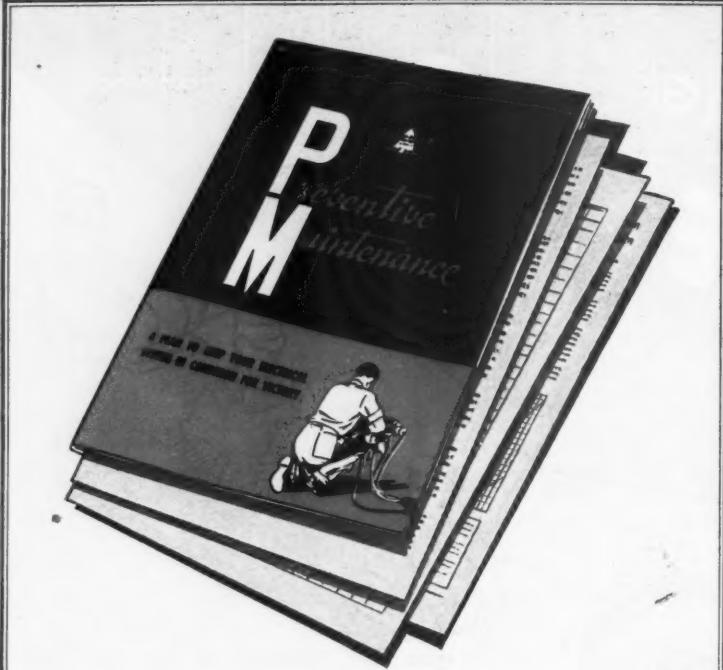


● Because good light helps good eyes do more . . . is even more helpful to older workers . . . efficient lighting has become a vital wartime production tool.

To be sure you give your employees all the seven* advantages of good lighting enumerated by the War Production Board for workers in War Plants, specify RLM Certified Lighting Units . . . identified by the RLM LABEL.

RLM Certified Lighting Units are built to rigid specifications developed by RLM Standards Institute. Rigid and continuous inspection of Electrical Testing Laboratories assures conformity to RLM Specifications by all manufacturers authorized to supply RLM LABELED Industrial Lighting Units.

For full particulars write any manufacturer of RLM Industrial Lighting Units, or RLM Standards Institute.



Industrial Plant Maintenance

—ESSENTIAL CONTRACTOR WAR SERVICE—
AIDED BY THE PM PLAN

With construction cut to a minimum for the duration, maintenance of industrial electrical equipment is the contractor's most important war job. By such a program, he has a direct hand in helping industry maintain continuous wartime production—despite shortages in essential wartime equipment.

Based on an annual maintenance agreement, contractors can offer: regular and systematic inspection and repair; service by specialists on electrical problems; broad experience gained over a period of years, in many plants; up-to-date methods and materials; proper tools and equipment, to do a thorough job.

To aid contractors in this vital activity is Anaconda's aim. With this in view, the Preventive Maintenance Plan was designed. Although introduced only recently, over 10,000 free Plan Manuals have already been sent out on request.

"Tomorrow may be too late...do it today!"

ANACONDA'S PREVENTIVE MAINTENANCE PLAN



1

WHAT THE PLAN IS

The PM plan is a simple but comprehensive guide which can help you maintain electric wire and cables in busy war plants and thus help safeguard continuous peak production.

2

HOW IT WORKS

The plan provides a practical means of making a periodic, systematic analysis of circuits and equipment. Uncovers potential weaknesses . . . suggests ways to correct them . . . prevents overloading of lines.

Data thus gathered aids local W.P.B. Branches in reaching decisions on requests for materials to prevent accidents.

NOTE: Your Anaconda Distributor will gladly cooperate in working out the program.

3

HOW THE CONTRACTOR BENEFITS

The PM plan assists in carrying out the all-important maintenance program. Helps keep business going and trained personnel together during construction lull . . . enables contractors to put employees on an annual, rather than hourly, wage rate . . . helps keep old customers, gain new ones, despite lack of products to sell . . . puts electrical contractor in leadership role for furthering the war effort.

If you aren't already utilizing the Anaconda Preventive Maintenance Plan, mail the coupon for full details.

4028011

Anaconda Wire & Cable Company
25 Broadway, New York City

Please send copy of the Anaconda Preventive Maintenance Plan for safeguarding wartime production.

Individual.....

Company.....

Address.....City.....

6P

Electrical Contracting, June 1943

Electrical Contracting

MAINTENANCE BACKS THE FIGHT

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War production is swinging into the hard slugging job of meeting quotas. Day and night, materiel of destruction beyond even the sadistic imaginations of the Nazis is flowing from factory to front in an inexorable procession. The basic war facilities are in action. The enormous task of filling the "pipelines" of distribution is well advanced. Planes, guns, and ships are reaching battle areas in quantities that only a few months ago would have seemed fantastic.

It took time to create those vast facilities. It took more time to fill the "pipelines." And much of our native skill and know-how went into that enormous job. Meeting production quotas, reconversion, cut backs, readjustments and special facilities are not going to be quite so dramatic. They are, however, even more essential to the tough job ahead. Today we know what American industry can produce. Military leaders will make their plans on the basis of that production. And the success of military campaigns will be determined by the reliability of machines and men on the home front.

A burden of major responsibility falls on maintenance and especially upon that vital key to all production schedules—electrical maintenance. In the months to come more and more of our industry will be concerned with upkeep, repair and trouble prevention. It will be faced with difficult material restrictions, scant manpower, and the accelerated wear and tear of round-the-clock operation of aging equipment.

In pre-war years there was always a practical limit to electrical maintenance responsibility. New apparatus was ready at a hundred warehouses, new wiring was available at the will of management and maintenance was concerned with getting a reasonable and economic life expectancy from available facilities.

Today we must have every possible hour of life, every ounce of power and every man-hour of labor saving value out of the wiring and apparatus at hand. Added facilities and new equipment must be applied with careful analysis of their contribution to production.

This is a brand new kind of job in planning and execution. Old and new wiring methods are being re-examined in the light of metal shortage and antique equipment is being rebuilt to handle new chores. And the men who keep the system running must be experts.

Electrical maintenance will need the best in skill and ingenuity during these coming months that our industry has to offer. It is an important job. And planned, organized electrical maintenance backed up by the wealth of experience and know-how in our industry can have a direct bearing on our military success in the difficult days ahead.

Wm. J. Stuart

JUNE, 1943



...when we switched to a new line of work

Another example of the time-saving gains of the Graybar MM* Plan

A new contract for war equipment put a Midwestern manufacturer on the spot. Although the firm was well equipped to build the new item, certain of the parts it required were of a type completely new to their purchasing staff.

Contact with Graybar, however, filled the gaps in their procurement "know-how". A GRAYBAR Representative was quick to supply the facts and figures they lacked on priorities, deliveries, specifications, prices. "Your Company," they later wrote, "has been unusually helpful in enabling us to obtain critical items used in our product, which were com-

pletely new to us in our new field of work."

Other companies switching from one product to another as a result of changing war demands are finding GRAYBAR unusually helpful in this respect. If the new product involves any type of electric circuit, or uses electrical

parts or subassemblies, contact with GRAYBAR can tie you in with over 200 leading suppliers. You get prompt, authentic information on their standard items, and their facilities for special jobs. Often, too, you get favorable delivery from GRAYBAR's local warehouse stocks right in your own community.

*Serving as your MATERIALS MOBILIZER

By this GRAYBAR service, your electrical needs are linked to the available output of 200 manufacturers, mobilized locally at more than 80 warehouses. The MM Plan "dovetails" GRAYBAR's procurement work with your own purchasing requirements. You save time in getting estimates, checking specifications, expediting delivery, locating "hard-to-get" items. Ask your local GRAYBAR Representative how this "one-call" service can help you.

Executive Offices:
GRAYBAR BUILDING
New York, N.Y.

GraybaR
IN OVER 80 PRINCIPAL CITIES



Electrical Equipment—Weapons and Tools

From miniature motors to mammoth generators, from tiny detector tubes to great broadcasting stations—everything electrical is essential to our war effort

As this editorial goes to press, newspapers and radio news commentators are telling the dramatic story of the blasting of two mighty Nazi power dams. Floods are sweeping down the Ruhr Valley, Germany's most vital munition production center. Two vast networks of industrial activity lie inert, for the great generators that had fed power to hundreds of plants producing war goods for Hitler, today stand idle. This daring raid will go down in history as one of the most, if not the most devastating of the entire war. It has destroyed two great sources of power, stopping the wheels in hundreds of plants and throwing into darkness thousands of factories and homes.

This epoch-making raid by the R.A.F. brings home to us the vital importance of our own power resources, those colossal generators from which flows the current that turns the wheels of our great industries, illuminates our factories and homes and runs our electric railways and subways. It makes us realize how dependent we are on electricity and how important is the part of those manufacturers who produce the electrical equipment that makes possible its generation and use.

Beginning with Thomas A. Edison, the inventive genius of electrical manufacturing men has devised more and more efficient ways of generating the current, better and better means of transmitting it and of applying it to do thousands of jobs quicker and better.

The products of electrical manufacturers have become so completely an essential component part of every industrial, business and domestic activity that our economy and our war effort could not go on without it.

In days of peace the laboratories of our electrical industry gave us radio, fluorescent lighting, infra-red drying, precision process-control, telemetering, split-second circuit breakers and many other things that border on the miraculous.

Today their facilities and their genius are devoted to an all-out war of wits with Axis scientists and production men.

Electricity plays a significant part in this war . . . from the "walkie-talkie" that brings support to hard-pressed outposts, to the mammoth motors on the battleships. While many electrical developments today are cloaked in secrecy, the nation will enthusiastically applaud these electrical manufacturers when the curtain is lifted.

The far-reaching importance of electrical instruments, apparatus and machines becomes evident when we consider that over 350 different electrical items go into combat vessels and that more than 170 go into a fighter plane. Most of these products are distinctly special in nature and are far removed from their civilian counterparts if, indeed, they have such counterparts.

To the civilian, a light bulb is something so standardized that every need can be filled by any nearby dealer. Our armed forces, by contrast, must have at their disposal

more than 400 distinct types of lamps. Some no larger than the head of a match, are so brilliant that they flash signals under a tropical noon sky. Others are built to withstand extremely low temperatures, vibration, shock and many other abuses to which they are subjected.

On planes, for example, numerous fractional-horsepower motors are used but the standard industrial motor is not suitable for this service. New records in low weight-per-horsepower had to be achieved involving extensive changes in design and production.

To prevent the light from instrument panels from impairing the vision of night fighters, ultra-violet radiation which activates fluorescent instrument dials was developed. As a result, the pilot may look out into the darkness after reading his instruments without the least effect on his eyes. How many precious air victories can be credited to this one development alone?

But, in general, the story of this industry's war work is much too blurred by military censorship to afford an adequate picture of its contributions. The factories and shipyards that are turning out war matériel tell a more complete story. Many of these have been built during the past two years. Others have gone through a complete conversion process. In every case, large quantities of electrical materials were involved.

In the broadest sense, there are three major jobs which this industry has had to do, in addition to equipping our modern war machine. It has had to supply materials for the vast expansion of our industrial system, keep every plant fully maintained, and provide the necessary equipment for the vital power and communication fields.

More than \$1,900,000,000 was spent for new industrial construction in 1942, and of this about 7% or \$140,000,000 was for electrical materials. New machine tools and other production equipment required an additional \$350,000,000 worth of electrical products. The conversion program called for another \$145,000,000 of electrical apparatus and supplies.

This total of over \$600,000,000 in itself would have staggered the electrical industry in a peace-time year. Yet, this record-breaking production was essential and had to be superimposed upon the direct requirements of the Army and Navy.

Industry depends upon electricity. Consider for a moment the effect of modern lighting upon war production. Industry enjoys levels of illumination and color quality that were undreamed of ten years ago. As a result, midnight shifts operate at daytime efficiency. As a matter of fact, many of the more modern plants have no windows at all.

Then there is maintenance. The failure of one single motor or feeder will stop a production line. Electrical manufacturers have had to stand at all times ready to

supply the heavy demand for the maintenance and repair parts that keep our industrial machine operating at top speed. Excess loads, 24-hour schedules and inexperienced production hands combine to shorten the lives of electrical equipment.

Electrical manufacturers have had to supply the greatly expanded needs of our power and communication systems.

New construction of all sorts — war plants, cantonments, war housing — has created a formidable need for additional capacity. Every element in our domestic economy has called for increased communication and power services. All this had to be superimposed upon the vast demands of our armed forces. The magnitude of this task is obvious but it is being successfully accomplished. Every old installation is functioning smoothly and every new one has been ready to function on exact schedule. There has been no failure either in our power or in our communication. Part of the credit for this performance belongs to the hundreds of manufacturers who delivered their products when and where they were needed.

This was not merely a problem of increasing production. These manufacturers had been depending on rubber, copper, aluminum and steel — all highly critical materials. For much of their non-military production they suddenly had either to find substitutes or practice the utmost economy and ingenuity.

Solutions to many problems were quickly found. Lighting manufacturers greatly reduced their use of steel by designing efficient, non-metallic reflectors. Wire and cable manufacturers expanded their use of synthetic insulation in place of rubber and they promoted the use of higher distribution voltages so that every ounce of copper would work more efficiently.

Steel is essential in apparatus that operates magnetically. There is no known substitute. But marked economies in its use have been achieved through the development of new alloys that are of increased magnetic efficiency. As a result, motors and transformers now consume substantially less steel than did units of equal capacity a year or two ago.

Electrical manufacturers have given our industries numerous new production tools. Infra-red heating tunnels, for example, have drastically reduced the time involved in production drying . . . in some cases from hours to minutes. High-frequency induction-heating has been spectacularly successful in the forging, brazing, hardening and casting of ordnance. Modern welding equipment makes possible speedy production with inexperienced labor.

America's production lines are being patrolled by electrical devices which eliminate human error. One million volt X-ray equipment looks through castings and points an unfailing finger at defects. An electronic flaw detector tests nonferrous drawn-metal tubing for imperfections.

Other electronic devices are counting and sorting the products of thousands of war plants. Precision controls regulate all sorts of processes, from aluminum production to armor plate annealing.

These are but a few of many examples of the way in which the magic power of electricity has been harnessed to the war effort. Back of every development there is at least one electrical manufacturer — more often many — who have pooled ideas and methods with no thought of royalties or dispute over cost allocation.

No story of the electrical industry would be complete that did not pay tribute to those manufacturers who have dropped their normal lines in order to produce special war products. Many appliance manufacturers fall in this group.

When war came, they did not stop to argue that civilian morale and big pay checks would demand a continued supply of their products, instead they quickly shifted to the production of war matériel and today they are deep in the manufacture of machine gun parts, aircraft sub-assemblies, and even gas-mask fabric. They have had to abandon their hard-won markets for the duration; but they are contributing mightily to permanent peace and a more prosperous world to which they will return when the guns are silenced.

This great industry has increased its production three-fold in two years — \$2,500,000 in 1940 to \$7,500,

000,000 in 1942. It has done this with all the zest of youth, for this is a young and a pioneering industry. Few companies in this industry are fifty years old; the majority are much younger. Top management in general is young, too, and many outstanding technical developments have come from the brains of men just a few years out of college.

The results of all its intensive intelligent work can be found in every factory, on every battlefield and ocean, and even in the flak-spotted air over Berlin. In a sense, the electrical manufacturing industry stands beside every soldier and every sailor as he goes into action. It has a place of honor it richly deserves.

And when this war passes into history, as it surely will, our soldiers and sailors returning to peace-time jobs, will find a life greatly enriched by electrical developments that were undreamed of yesterday.



President, McGraw-Hill Publishing Company, Inc.

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POWER and LIGHT

for

SHIPBUILDING



SHARP CUT-OFF of upward light can be noted in this night picture between two shipways. Lighting units are mounted in the scaffolding, directed downward and are shielded against upward spill.

SHIPYARDS demand such electrical capacity and present such a dimout problem from a lighting standpoint that when one of the multitude of new yards built recently under the stress of war develops some methods to cope with these and many other similar electrical problems, it is worth looking into. Such is the Marinship yard on San Francisco bay, whose electrical distribution system is unique and whose dimout light control has made it possible to claim itself the best in the country in that respect.

Working 24 hr. schedules and employing electric welding so extensively, modern shipyards require a distribution system that insures continuity, provides a large factor of safety, is extremely flexible in diversifying its loads, and yet saves copper and distribution equipment. Night work out of doors on the hulls, plus usual location of the yard near the ocean make the difficulty of control of light in an upward direction a major undertaking. These extremes are met successfully at the Marinship yard, whose engineering has been done

Electrical systems for welding, power and lighting to build vital war shipping involves elaborate interlocked distribution and flexibility.

by Bechtel-McCone-Parsons Corp., engineers-contractors, and installed by this contracting firm and by other San Francisco bay region contractors such as Crown Electric, Galvin Bros., Kenney & Langlais, Kuchel & Sievers, Lynch & Scott, Pacific Electrical & Mechanical Co. Design was done by James Moore Evans. Superintending electrical construction was George Garthorne, of W. A. Bechtel Co.

Basically, the distribution system design develops from a selection of 12 kv. rather than 2,300 volts for primary voltage, which permits a standardization on 500,000 cir.mil conductor instead of 1,750,000 cir.mil, and also makes for better current carrying capacity and less reactance loss. Roughly the system is arranged in a geographical double loop around the yards but neither loop

is closed electrically. This provides the convenience of a loop arrangement for the transfer of load in case of trouble, failure or damage at any point in the system, without the expense of a complete network or loop in apparatus and equipment.

Standardization was also possible on 500,000 cir.mil conductor for the secondary power distribution by division of the load into 400-amp. groupings. By this conductor standardization other advantages gained were: easier and faster installation of the smaller sized conductor, savings in copper, rubber and insulation and lead sheathing, warehousing simplification, easier replacement.

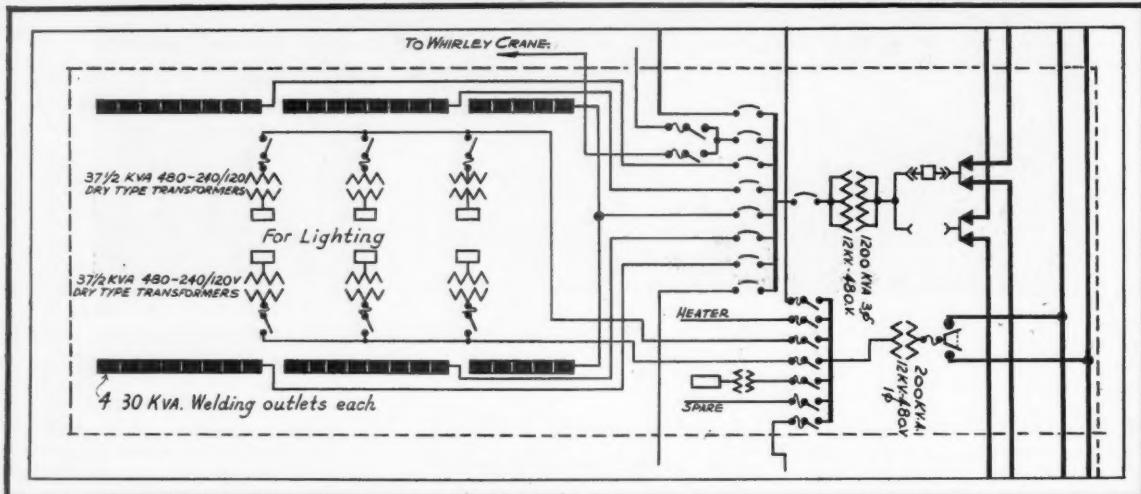
The yard was divided into two approximately equal sections, each looped mechanically or physically by two sets of primary feeders from separate circuit breakers in the main substation. Each unit of load, such as a shipway, shop or other fabricating or outfitting plant, is served from one or more 1,200 kva., 12-kv./480-volt, 3-phase unit substation of the metal-clad, outdoor type, equipped with drop-out primary oil cir-



UNIT SUBSTATION installed in one of the shop buildings. Primary side plainly lettered "12,000 volts".



TYPICAL SHIPWAY SUB during construction showing power-unit sub at the left and transformer, conduits and potheads for lighting.

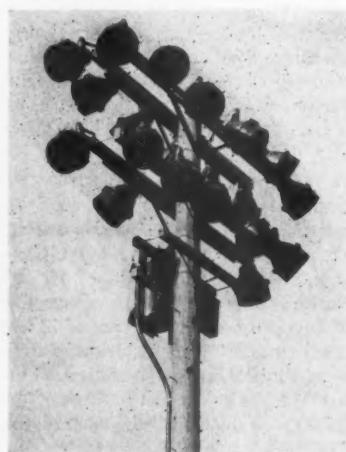


TYPICAL SHIPWAY distribution diagram for both power and lighting showing selectability of two main feeders in each case and inter-tie of secondaries as well.

cuit breaker and pull-out air-break secondary breakers. With the drop-out oil switch on its own truck, connection can be made in that same unit substation to either of two primary feeders coming into it.

Manholes are avoided where sea level rises with the tide. Therefore the cable was pulled directly into its section of the unit sub through a pothead. Removable links, whose slots are held by a bolt at each connection, connect the cable to the oil breaker. Loosening of the bolts and removing of the link isolates that unit in case of trouble or damage.

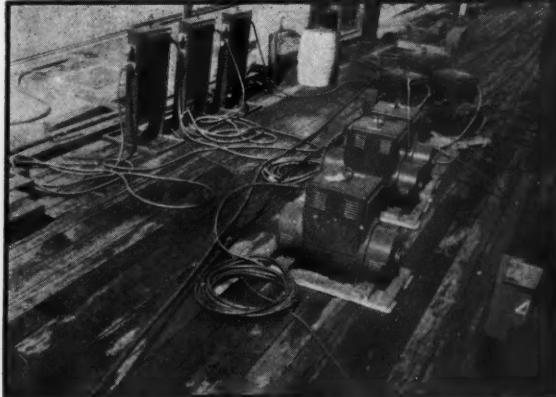
To further provide for continuity and give each section of load the benefit of diversity of neighboring units of load, the secondaries were also tied together by means of air-break, 400-amp., 480-volt 3-phase circuit breakers and 500,000



BANK OF LOUVERED FLOODLIGHTS atop a 60-ft. pole, typical of the yard lighting for night operations.

cir.mil cable. This tie is made between substations adjacent to each other. Loads were then divided into 400-amp. blocks and circuits loaded to capacity to get the maximum use of the copper. Power loads consist chiefly of a.c. or d.c. welding sets. Secondary power at 480-volts is distributed to groups of four 30 kva. or 25 hp. welding panels on the shipways to furnish energy for 500-amp. a.c. or 25 hp. motor-generator sets which convert the a.c. to supply 400-amp. d.c. welding. To balance the load, the a.c. welders, which are single-phase, are arranged equally on the three phases.

A similar loop idea is used for lighting distribution, although some exceptions were caused by changes in location and increases of load. Two sets of No. 4 feeders circle the yards, one going in one direction, the other around



WELDER PANELS along a shipway, with portable welding sets plugged into Arktite plugs with pull-out fused switches.



A.C. TRANSFORMER WELDERS plugged into a power panel in one of the shops.

the other way. Either line may be selected at each lighting substation to serve that sub through load interrupter disconnect switches of 400-amp. rating. Lighting subs step down the 12 kv. to 480 volts for shipways and to 120/240 volt for buildings and shops. The phase loads are balanced across three sections of the yard. Far less critical materials and much less cost are advantages of these interrupters over oil breakers. They interrupt the current in less than a cycle.

Similarly interconnected on the secondary side are the lighting substations. A circuit breaker at each end of the panel is connected to the next neighboring substation secondary bus. Lighting feeders are run at 480-volts, 200 amp. to the staging of the shipyards. There, dry-type 480/240/120-volt, 3-wire, single-phase transformers and an adjacent panel distribution center are located. At the outfitting docks, for the lighting aboard ship, 480-volt receptacles are provided for connection by

portable cable to portable transformer and panel units mounted in a steel cradle, fitted with a lifting ring, so that it may be picked up by cranes and placed wherever wanted on shipboard.

Power for shipboard welding is taken from power welding panels on the dock to shipboard by heavy cables to portable 480-volt, 3-phase switchboard panels and receptacles. Portable welding sets, m.g. d.c. sets, ventilating fans, etc., can be plugged to these. Lighting and power are kept separate everywhere, even for work on board ships. This has numerous advantages, particularly for blacking out from a main source.

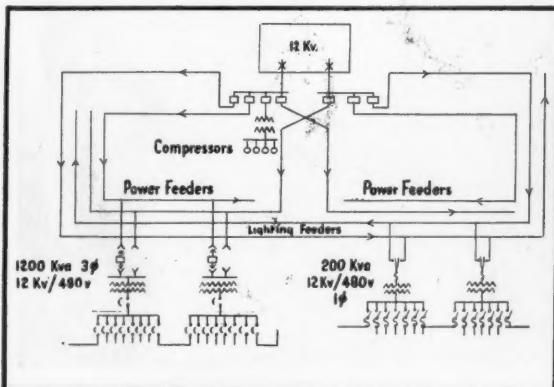
Certain feeders from the main substation are arranged to maintain service, continuously during blackout to essential offices, hospitals and other essential buildings as well as to air compressors and to all electric clocks. Centralized supply makes possible quick blackout by opening a minimum number of circuit breakers.

Night work on an extensive scale

calls for plenty of yard and floodlighting and electric arcs from welding operations are particularly hard to confine. Yet such large areas even of controlled outdoor lighting contribute far too much to skyglow or loom not to be a potential hazard to security. Although West Coast defense command dimout proclamations permit reasonable deviations from the strict dimout rules where vitally necessary war production work requires it, the problem of obtaining even reasonable control at a large outdoor shipyard was considerable. At first it was thought that by high mounting of lighting reflectors on buildings and poles the angle of tilt downward would keep the beams well below the horizontal as required, but it was found necessary to paint the inside rim of the reflector at the outer edge or to equip them with louvers.

The job involved about 800 floodlights on poles and structures ranging from three to a pole to 35 along the edge of

(Continued on page 117)



SCHEMATIC DIAGRAM of the electrical distribution system for both lighting and power.

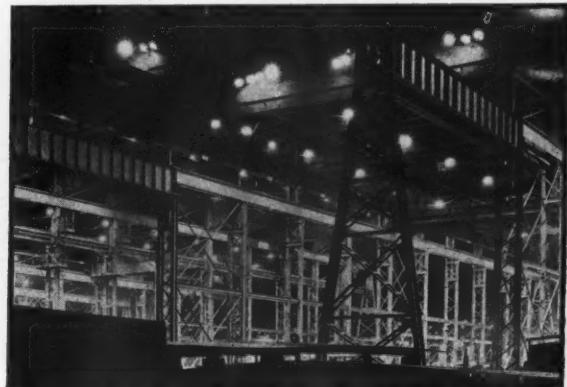


PLATE SHOP with lighting units mounted on wall sections just below the roof. Interior lighting is high bay incandescent.

SHOP

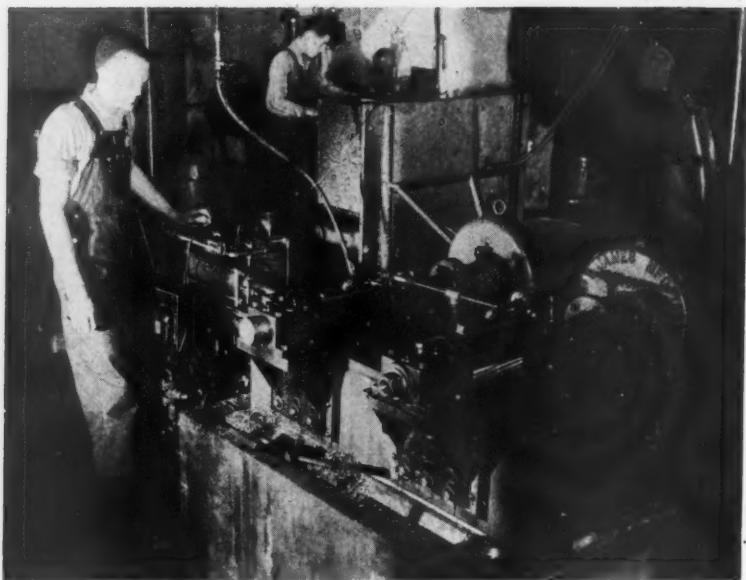


FIG. 1—TWO SPINDLE MILLING MACHINE has motor driven arbors and a hydraulic ram to operate the reciprocating bed. Valves in oil line provide forward and reverse motion and speed control of bed. Set up here is for slab milling and serrating.

UNDER the pressure of accelerated war production we find ourselves doing what normally would have been considered the impossible. Production figures are skyrocketing, plant capacities are being raised and subcontracting has become a vital part of manufacturing. Motor repair shops, normally considered a service group primarily interested in the inner workings of electrical equipment, are taking a substantial part in the overall production picture.

Outstanding among motor shops doing actual war production work is the Industrial Electric Works of Omaha, Nebraska. The ingenuity of its owner, Bernhardt Stahmer, made possible the complete conversion of the machine shop department to war work under subcontract to prime contractors. His healthy flair for machine design has enabled him to hurdle priority difficulties and delivery delays to get his shop in production in the shortest possible time. By design and application of novel jigs and fixtures he made his existing machines do the job of larger and more diversified equipment. And to top it off, when he couldn't get quick delivery on a necessary milling machine, he designed and built his own.

This unique piece of equipment, (Fig. 1) costing about \$2700, was designed, built and in operation in approximately six weeks. Delivery on a conventional milling machine would

have been anywhere from eight to sixteen months and at about five to six times the cost. A good chunk of ingenuity, a couple of scrap gear reducers, a couple of used electric motors and controls and a hydraulic ram form the nucleus of the unit.

The concrete base on which the machine is mounted is hollow inside, providing a 48-in. by 12-in. cutting oil storage tank whose walls are covered with an oil resisting paint. A motor

driven circulating pump sprays the oil, under protecting hoods, over the milling cutters. A nozzled air hose is used to blow the metal chips from the spiral cutters, which were made in the shop.

The reciprocating 15-in. by 56-in. bed is actuated by a hydraulic ram controlled by a series of four valves in the oil line (See Fig. 3). The two valves are for forward and reverse operation of the bed; bleed valves control the bed speed. An ordinary water pump, adapted for use with oil, provides a hydraulic ram pressure of approximately 400 lbs. per sq. in. Critical speed of the pump to eliminate pulsating action of the reciprocating bed was predetermined by experiment.

The two milling arbors revolve in 7-in. bronze bearings housed in cast iron pillow blocks fastened to cast brackets bolted to the base of the bed. The arbors are coupled to two 80 to 1 ratio worm type gear reducers which are V-belt driven by two variable speed slip ring motors, one a 5 hp.; the other $\frac{7}{2}$ hp.

Two specific operations are per-

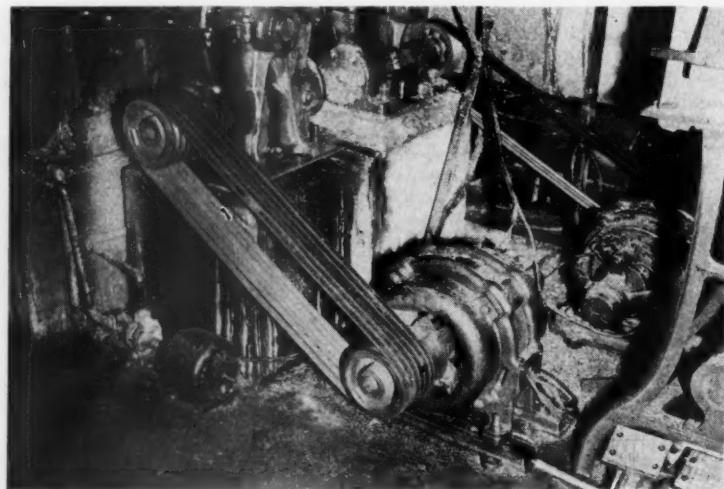


FIG. 2—ARBOR DRIVES on milling machine are slip ring motors V-belt connected to the worm reduction gear boxes. Because of time element wiring is temporary.

CONVERSION to WAR WORK

An Omaha electric motor repair shop transformed its machine shop into an efficient war production unit. Application of ingenious jigs extended usefulness of existing equipment and a home made milling machine increased the shop's capacity

formed by the setup shown in Fig. 1. The arbor nearest the hydraulic ram slab mills one side of the 7-in. square piece of 1½-inch metal; the second arbor serrates the other side. The work is indexed and automatically centered by jigs fastened to the reciprocating bed, thus reducing the setup time to a minimum.

Efficient and Flexible

Because of its squat nature, the bed being only 35 inches from the floor, the designer claims an operator can work faster than on a conventional type of machine. Avoidance of chatter is another feature attributed to this unit. Flexibility is provided by slotted openings in the pillow block supports which permit vertical adjustment of the arbors for work of varying thickness. Adaptation to other types of work is simple. If necessary it could be quickly transformed into a planer. Because the machine was originally designed for continuous milling of flat bars, openings were left in the bed table for the instal-



FIG. 4—BORING JIG transforms a conventional drill press into a boring machine. Heavy construction eliminates vibration permitting an accuracy of .002-inch. Flame cut holes are finish bored here.

lation of an underside cutter. A smaller unit could be built for milling smaller parts.

Other Short Cuts

Before going to the milling machine the work goes through two operations. Flame cutting of a large opening in the center of the metal slab is the first. To speed this operation a turntable was built flush in the metal cutting table. Normally, the cutting machine revolves around the work. Conversely, Mr. Stahmer made the work revolve and kept the cutting machine stationary. The turntable is ball bearing mounted and turns at about one r.p.m. A jig on the turntable automatically centers the work and permits the flame to cut a perfect circle. The flame is started inside the circle and then a twist of a knob moves the burner to the edge and the turntable does the rest. A considerable saving in oxygen is affected by having the flame burn continuously since it takes only a second to place a new slab on the table.

[Continued on page 70]

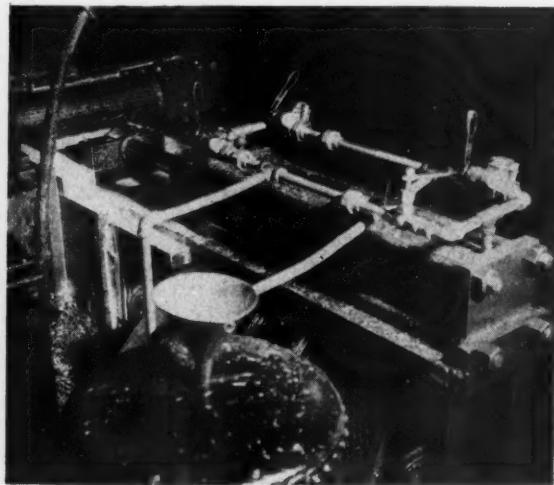


FIG. 3—VALVE CONTROL on hydraulic ram consists of valves for forward and reverse and bleed valves for bed speed. Plunger connects to the reciprocating bed.

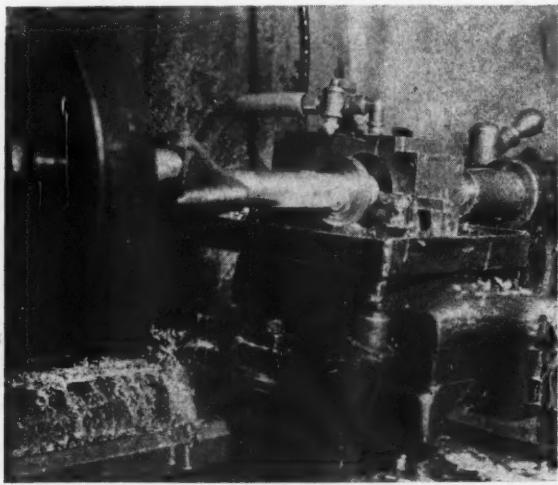


FIG. 5—CUTTING JIG on a 16-inch lathe permits cutting a 2-1/16-inch shaft to 1-inch diameter in a single operation. Cutting tool has a counterpart diametrically opposite.

FIG. 1

DOUBLE TAB CHECK consists of (1) office file tab; (2) employee's tab showing his earnings, payroll deductions and net amount of check; and (3) the check proper which the employee cashes.

THE SULLIVAN ELECTRIC COMPANY CINCINNATI, OHIO			EMPLOYEE JAMES A. Johnson						
PERIOD ENDING	CHECK NUMBER	HOURS	EARNINGS			DEDUCTIONS			NET AMOUNT OF CHECK
			AMOUNT	OVERTIME	TOTAL	F.I.C.	WORLD WAR BONDS	TOTAL	
1-9-43	1989	40	\$56.00		\$56.00	\$0.56	\$2.10	\$0.80	\$47.74

DETACH AND RETAIN THIS TAB. IT IS YOUR RECORD OF EARNINGS AND CORRESPOND TO RETURN MADE AS REQUIRED BY LAW.

THE SULLIVAN ELECTRIC COMPANY
938 REEDY STREET
CINCINNATI, OHIO, January 9 1943

No. 1989

DOLLARS

THE SULLIVAN ELECTRIC COMPANY

TO SECOND NATIONAL BANK
CINCINNATI, OHIO

SIMPLIFIED OFFICE METHODS

TOO often shops are prone to direct their energies to evolving short cuts in their production departments and neglect the front office where the majority of the paper work is done. Not so with the Sullivan Electric Co., Cincinnati motor service shop, whose Selden High realizes that office efficiency is just as important as shop efficiency. When he goes hunting for simplification, he usually comes up with a time-saving production-accelerator that knocks the spots off his former methods—whether it be applicable to shop practice or office routine.

He recently uncovered and adapted

The adoption of a simplified payroll system and a continuous invoicing method has accelerated the clerical department output of this Cincinnati motor service shop. The schemes can be used equally as well by contractors.

for his office a unique and extremely simple method of making up payrolls—a system whereby the check and permanent record are made in one operation. A product of the Korb Lithographing Co., Cincinnati, the system consists of a double perforated tab check and an 8½-in. by 12-in. combination permanent

payroll and personnel data sheet.

The horizontal tab (2) of the payroll check Fig. (1) has a series of columns listing the earnings and a breakdown of payroll deductions as illustrated. This tab is detached by the employee before cashing the check and is his personal record of his earnings and deductions. The vertical tab (1) contains the check number. The employee's name and amount of the check can be added, if desired. After the check is made out this tab is detached by the bookkeeper and kept on file until the cancelled check returns.

The permanent record sheet (Fig. 2) has columns corresponding to those on the horizontal check tab. Personnel data at the top and bottom is an integral part of this master payroll form. The numbers on the right hand edge of the payroll sheet represent weekly periods divided into quarters (13 weeks). A horizontal column at the end of each 13 weeks is for quarterly totals for payroll analysis and reports. Both the numbers at the right and left edge of the sheet aid in aligning the check when it is typed and assures that corresponding vertical columns match and the data will be transferred on line 1, 2, etc.



CONTINUOUS FORM INVOICES complete with an attachment fitting a standard typewriter speed up monthly billing. Each stack contains about 800 invoices in triplicate. Carbon sheets are rolled back by turning hand wheel at upper right of attachment, after invoice is fastened to pegs. Next set of invoices is all set at date line, ready for typing.

FIG. 2

MASTER PAYROLL SHEET with the employee's personnel record as an integral part. Carbon impressions of wage and deduction data on employee's check tab, provides a permanent payroll record. Columns can be totaled quarterly for analysis and payroll reports.

1	Johnson	James	Arthur	B-NO. 545-01-676	CO NO. 56					
EMPLOYEE'S LAST NAME MARRIED WOMEN GIVE MOTHER'S FIRST NAME AND HUSBAND'S LAST NAME)		(FIRST NAME) (MIDDLE NAME)								
THE SULLIVAN ELECTRIC COMPANY CINCINNATI, OHIO										
(2) EMPLOYEE James A. Johnson										
PERIOD ENDING	CHECK NUMBER	HOURS	EARNINGS			DEDUCTIONS			NET AMOUNT OF CHECK	
			AMOUNT	OTHR.	TOTAL	F.I.C.	VICTORY TAX	W.H.B. DEDS.		TOTAL
1-28-45	1989	40	\$56.00		\$56.00	\$0.56	\$0.10	\$5.60	\$0.46	\$47.74
DETACH AND RETAIN THIS SLIP. IT IS YOUR RECORD OF EARNINGS AND CORRESPONDING TO RETURN MADE AS REQUESTED.										
PAYROLL CHECK						(3) No. 1989				
THE SULLIVAN ELECTRIC COMPANY 838 REEDY STREET						CINCINNATI, OHIO, January 2, 1945				
Pay TO THE ORDER OF: James A. Johnson						\$47.74				
Forty Seven and 74/100						DOLLARS				
TO SECOND NATIONAL BANK 18-2 CINCINNATI, OHIO						THE SULLIVAN ELECTRIC COMPANY				

FIG. 3

CHECK ALIGNMENT with master sheet (at arrows) is made before they are inserted in the typewriter. Data inserted in columns of tab (2) will appear on the master sheet for the first week. Alignment for next entry is made at the number "2" at each edge of the master sheet.

FIG. 4

INVOICE SHEET torn from a continuous strip of invoices. Note the removable breakdown tab at the bottom of the sheet. This is removed, from customer copies, but is retained as a record on the office copy.

Before being placed in a typewriter, the check is laid flat on the face of the sheet with the horizontal tab column in line with number 1 on the right (Fig. 3 arrow) and the upper left corner of the tab in line with number 1 on the left. The vertical tab is folded over the back of the sheet so it will prevent the check from shifting when inserted in the typewriter. A patented carbon strip on the back of the data column on the horizontal check tab (2) transfers the information permanently to the payroll sheet. Each weekly check is typed on the sheet so that at the end of a quarter, 13 carbon entries will appear. The reverse side has space for entries during the last two quarters.

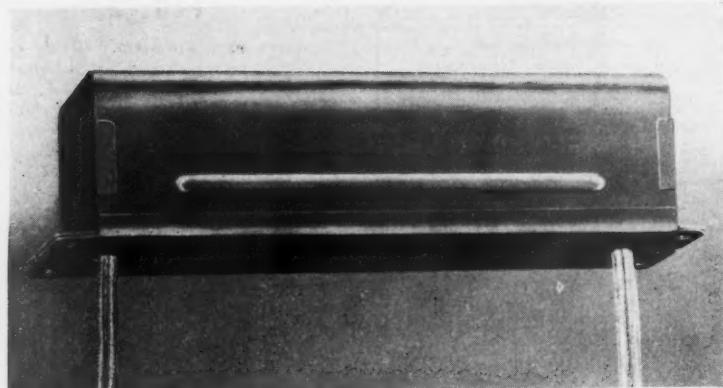
Thus, only one operation is necessary to make out the payroll check and permanent entry on the master sheet. With tables of deductions for social security, victory tax and bond purchases handy, the bookkeeping is greatly simplified. No need for transposing entries from

the check to master sheet and numerous deduction records.

Now that the weekly headache of making out the payroll had been licked, Selden turned to that monthly billing chore. The former method of using triplicate invoices in pad form required five operations: tearing off the pad,

inserting two sheets of carbon, inserting and aligning in typewriter and typing, removing from typewriter, and removing carbon sheets. The continuous form invoicing method recently added to the Sullivan Electric Company office materially reduces lost time.

[Continued on page 171]



TYPICAL MAZDA F LAMP ballast with leads brought out through the bottom of the case for installation atop fixture wiring channel.

Ballast Design Advances

Advances in ballast design conserves materials in fluorescent lighting installations.

By C. Stonehill *General Electric Co.*

THE fluorescent lighting industry, only five years of age, has fallen heir to a full time war job. With a 100 percent changeover from civilian to war production, this industry is taking care of the sizable task of lighting war plants for 24-hour operation on detailed high-speed production jobs.

This changeover has meant the discontinuance of manufacture of hundreds of thousands of 15, 20 and 30-watt lamps, auxiliary equipment and fixtures, allowing full-speed production of the 40-watt and 100-watt components required for industrial lighting. Steel has been replaced as a reflector material. Developments in supply circuits for lighting loads, and in control equipment, or ballasts, have added to the changing picture, and have also contributed largely to savings in mate-

rials. Even though fluorescent lighting is one of the most economical means of obtaining the high levels of illumination required for today's war job, every effort is being made to reduce still further the amounts of critical material required.

Ballast design is dependent upon lamp characteristics and the voltage and frequency of the supply circuit. Use of circuit voltages, equal to the starting voltage of the lamps, results in material savings in the ballast since no auto transformer is required within the ballast itself for stepping up voltage. During the past year many war plants have installed 460-volt wye-connected circuits providing 265 volts from line to neutral for lighting loads. This system results in savings in plant wiring when compared to a 230/115-volt,

radial system. From the standpoint of ballast design the use of this circuit is required for utilization of the Forlamp 100-watt ballast. Two 100-watt lamps are operated in series from 265 volts. A sequence-starting circuit and standard thermal-type starter switches are used. A leading-power-factor and a lagging-power-factor ballast are combined, as in the Tulamp ballast, resulting in a compact unit for the operation of four 100-watt lamps. This Forlamp ballast requires approximately the same amounts of materials as are required in a 100-watt Tulamp ballast. This 50 percent reduction in ballast materials equaled approximately 76 tons of steel, copper, and aluminum on the first fluorescent lighting installation in which it was used.

Another outstanding example of material conservation is the three-lamp ballast for 40-watt lamps, designed for operation on 208 volts, 60 cycles. As the 40-watt fluorescent lamp requires approximately 200 to 208 volts for starting, this circuit has been used advantageously in developing a 208-volt ballast that requires no additional transformation of voltage within the ballast. The ballast reactors for three lamps and the necessary capacitor for split-phase operation and power-factor correction are uniquely combined in one housing.

Advancements in design of ballast equipment also are dependent upon changes in fixture design. The reduction in the steel content of the fluorescent lamp fixture has received considerable attention and fixture manufacturers are now generally using substitute materials for reflectors. To make possible material reductions in the steel used for wiring channels, changes in ballast design have been made to permit mounting the ballast outside and atop the wiring channel, the cable connections being carried from the ballast to the lampholders through a very small wiring channel. For this application, ballasts, now available, have the leads brought out through the bottom of the ballast case. The ballast is mounted on top of the wiring channel and the leads are brought directly into the channel.

Design practice has advanced through co-operation of fixture designer, ballast engineers and plant engineers. It is interesting to note that the design of one element depends upon the design of all other components going into the installation. Lamps, fixtures, ballasts and starters must operate as a co-ordinated unit. Also, as already shown, the available circuit voltage is a determining factor in ballast use.

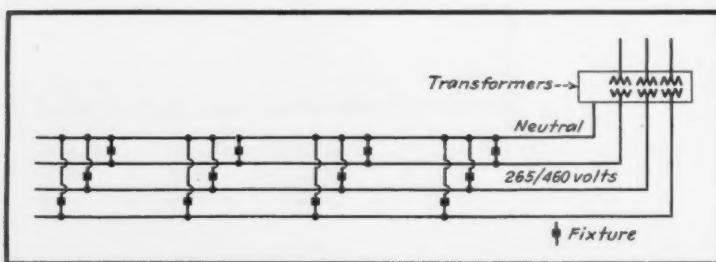


DIAGRAM SHOWING CONNECTIONS for fixtures using Forlamp ballasts on 265-volt circuits derived from lighting transformer banks.

Digest of

WARTIME ELECTRICAL MAINTENANCE PRACTICE

The planning, priorities and know-how of electrical maintenance for the men who must keep circuits and equipment at top efficiency and reliability for war production.

Electrical Maintenance



Electrical maintenance is the guardian of continuous war production. It demands the same careful organization and operation as the production or assembly lines. It requires able management. Unless the energy lifelines to operating equipment are kept in A-1 condition, efficiency cannot be maintained and production will suffer. Ailing electrical systems constitute more than a mere liability today — they are, in effect, the equivalent of internal sabotage.

Industrial progress had doomed the old "fix it when necessary" conception of electrical maintenance. Today's problem, under wartime operation, is to reduce to an absolute minimum the possibility of breakdown with its attendant loss of machine hours, man hours and production units. Present day maintenance is "preventive." It embodies a planned program to anticipate trouble; to keep electrical systems and equipment operating and to make existing equipment last for the duration.

THE PROGRAM

The maintenance program includes a plan for making periodic inspections of all electrical equipment. Not just cursory checking, but a thorough inspection with all the necessary instrument tests to determine the actual condition of the electrical system and its equipment. It means keeping a complete set of records containing data on all equipment and the findings of each inspection. The scope of maintenance covers everything from proper selection and application of equipment to do the job at hand to the actual control of maintenance costs.



THE STAFF

The electrical maintenance staff personnel in the larger industrials usually follows this pattern:

Headquarters, the office of the electrical maintenance organization is headed by the electrical maintenance engineer or chief electrician. He is responsible for the operation and maintenance of all electrical equipment. He has the responsibility of choosing equipment; maintaining spare parts and material supply; engineering system changes and organizing a smoothly operating maintenance program. He may have one or two assistants (night and day) and a secretary or clerk to keep the necessary paper work in order.

Supervisory personnel comprises the electrical maintenance foreman, shift foremen or crew leaders. Large plants often have several subforemen depending upon the size of the maintenance department and the sphere of responsibility delegated to each

PLANNING

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crew. There may be a maintenance crew chief for distribution circuits, motors and equipment, controls, lighting and so on. Or, there may be subforemen for different plant areas. In any case, these subforemen are responsible for the maintenance of electrical equipment in their designated areas or specific equipments. They report directly to the electrical maintenance chief.

Working Crews are under the direct supervision of their shift foreman. They use the tools, make the tests, inspections and repairs and report their findings. They know the pulse of the system on which they work, and sense trouble before it has a chance to materialize. Organization of working maintenance crews usually falls in one of the following categories:

1. *Plant crews* that cover all electrical maintenance. These are generally found in smaller plants where the equipment is not too complex.

2. *Crib crews* working in specific localities. Such crews are spotted at strategic points throughout the plant to take care of maintenance within certain areas. They are equipped with their own tool and spare parts crib with sufficient material to handle normal maintenance and repairs. Each crew has a leader and several may be under one foreman.

3. *Emergency crews*, trained to function efficiently under emergency conditions. Such squads are recruited from various crews in the overall maintenance organization, to prevent drastic depletion of the manpower of any one crew during an emergency. These emergency squads are schooled in the art of making temporary repairs, if necessary on "hot" circuits, to keep equipment in operation while permanent repairs can be made.

4. *Specialist crews*, individual or groups working on a specific assignment, are men with special training or experience who can tell in a jiffy if a piece of equipment can be repaired on the spot or if it should be replaced and sent out for repairs. A person who knows the inner workings of motors and controls can be of great help. And, with the increased application of electronic devices in industry, a person trained in this field can save the maintenance department many a nasty headache. Specialists are hard to get. It is wise to train likely members of the maintenance department in such specific fields.

SPARE PARTS STOCK

Central stockrooms are the focal point of maintenance stocks. To facilitate handling and checking these are located either in or adjacent to the main plant receiving room and stockroom. Electri-



Electrical Maintenance PLANNING

CARE OF PORTABLE ELECTRIC TOOLS

Periodically do the following:

- 1 Renew grease in gear case and armature bearings — wash out old and dirty grease, coat underside of gears with grease and pack case one-half full of a good grade medium grease.
- 2 Inspect carbon brushes and commutator. Clean or smooth commutator. Do not allow brushes to wear within one-third of their original length as that will usually cause open or short circuits in the armature. Flashing will be caused by infrequent contact of brushes with commutator due to reduced spring tension.
- 3 Clean dirt from all ventilating holes and slots.
- 4 Inspect cable for breaks.
- 5 Inspect and tighten switch connections.
- 6 Wash accumulation of dirt and chips from chuck jaws.
- 7 Tighten all screws.

When a tool fails to operate, check for the following:

- (a) Brushes not making contact.
- (b) Broken motor lead.
- (c) Broken cable.
- (d) Switch not making contact.
- (e) Open circuits in the armature.
- (f) Open circuit in field coils.

cal stocks should be kept separate from others. Such a stockroom should also accommodate tools and instruments, thus confining everything pertaining to the electrical system in one specific area.

Basic stocks should include the following:

1. *Spare apparatus* — including motors, frames and armatures, sheaves and pulleys; control apparatus and switches; small circuit breakers; lighting fixtures (several of each type — depending upon the number of units in the plant); small distribution transformers. Apparatus of this type is specifically retained for emergency replacement to carry on operations while the defective units are being repaired. For example: one large industrial plant with approximately 4,000 motors in service maintains a stock of 150 spare armatures of different types and sizes for emergency replacement purposes.

2. *Repair parts* for all types of electrical equipment in the plant. This would include such items as motor bearings, bushings, oil cups; control overload heater coils, relay coils, contact points, fuses and links, lamps, fluorescent lamps, starters, auxiliaries, sockets and similar items.

3. *Wiring materials* should include, conduit, conduit fittings, solder, solder and solderless type cable connectors, wire and cable, tape and insulating compounds, bus plugs, switches and cable, 4-conductor cable for machine drops and other miscellaneous items.

Stock cribs are area distribution points for maintenance stock to supply crib crews working in specific areas or locations. Fed directly from the central stockroom, they have sufficient quantities of apparatus, spare parts and wiring materials to satisfy normal maintenance and emergency requirements of the area and crew served. They should also contain the normal complement of tools required by the crew and space for the men's tool kits. If possible, a clamp-on type ammeter and a voltmeter should be in each crib. All stock cribs have telephone communication with the central stockroom to facilitate requisitioning any additional materials or special tools when necessary. This particular plan of decentralizing the plant maintenance organization has been applied rather extensively in large manufacturing and assembly plants that cover considerable areas.

Portable trouble kits vary from a small strap supported kit the mechanic slings over his shoulder to the combination workbench and spare parts cabinet that can be rolled anywhere in the plant. The kit should contain the ordinary run of electrician's tools. The type of spare parts in the kit will depend upon the type of system he is maintaining. For example, for lighting maintenance some plants use combination rolling scaffolds with a high platform for servicing the lighting units, and the combination workbench and cabinets for spare parts and lamps. The same scheme is applicable to other phases of the electrical system maintenance.

STOCK QUANTITIES

The amount of stock to keep on hand is a problem that only the head of each individual plant maintenance department can answer. Actual quantities must be determined from past experience on the frequency of shutdown of specific equipment and the amount of repair and maintenance required over a specific period.

The following provides a good starting point for developing the maintenance stock:

1. Find the *minimum* stock that would enable the plant to cope with any single ordinary emergency and *earmark for emergency use only*.
2. Determine the delivery period required for repair parts. Acquire a stock sufficient to carry on plant operations for that period of time. Add this stock to that already earmarked as "emergency items."
3. Augment by stripping all usable parts from equipment ready to be junked and use as a reserve.
4. Salvage all usable short lengths of wire and cable.
5. Use all reclaimed materials and parts before dipping into the new repair items.
6. Make it an iron-bound rule that whenever "emergency" stocks are used they must be replaced immediately.

Ordering Replacement Stock — The maintenance department must have ample authority to order maintenance repair parts. The practice of waiting until a sizable order accumulates before placing it with the supplier, should not be tolerated. Likewise, the practice of ordering huge quantities to take advantage of a lower price robs other plants of parts sorely needed for repairs or operation.

All stock requisitions should be handled in the central stockroom, as is the distribution of present materials and ordering of new items. The stock clerk should always have an up-to-the-minute picture of the stock situation. He should also have a record of all the suppliers and their best delivery promises; also a record of where to go for emergency help in the way of materials or manpower assistance. This list should contain the names of two or three of the leading electrical contractors and motor service shops in the area so that outside help is available if necessary.

Another recent activity in some plants is the development of a reserve pool of repair stocks. A list of the reserve parts stock (in excess of emergency needs) is made of all plants in a neighboring area and circulated among all of them. If a breakdown occurs and an item is needed in a hurry, the maintenance department can consult this list, call on the plant having the item in question and get it pronto. When the replacement comes through from the supplier, it is returned to the plant from which it was originally received. Serious shutdowns and production snags can be avoided in this simple manner.

ELECTRICAL SYSTEM SURVEYS

The following are important surveys that can be made with instruments to determine the condition of the plant electrical system:

LOAD SURVEY

- to determine if motors, transformers and feeders are operating within rated limits.

VOLTAGE SURVEY

- to determine service and distribution voltage and voltage drop in feeders.

POWER FACTOR SURVEY

- to determine the power factor of individual equipment or circuits and the overall system power factor condition.

INSULATION SURVEY

- to determine insulation resistance of feeders and motor coils to locate deteriorated or damaged cables which might cause a sudden breakdown.

GROUND RESISTANCE SURVEY

- to determine if ground resistances are within prescribed limits and that all connections are secure.

LIGHTING SYSTEM SURVEY

- to determine the efficiency of the lighting system and working plane intensities. Such surveys often lead to other check-ups with resultant recommendation for better lighting to increase production.

Electrical Maintenance PLANNING

TOOLS

Tools are the working equipment of the department and the more complete this stock is, the more efficient will be the operation of the maintenance crew. The size of the tool stock, duplication of items, number of special tools and number of instruments will depend on the size of the plant and the job the maintenance department has to do.

In general the tools of the maintenance department can be grouped into four distinct categories: mechanic's tools, shop tools, special purpose tools and machines, and last but not least, instruments. The majority of these items are usually stored in the central tool and equipment room. Departmental or area tool cribs should contain the individual's tool kit and perhaps a few heavier items such as stocks and dies, vise, workbench, ammeter, voltmeter and wattmeter. Any other tools or instruments that might be necessary to do a specific job can be easily requisitioned from the central tool room.

Mechanic's tools consist of a complete assortment of small hand tools necessary to handle the routine maintenance job. They are usually the mechanic's personal equipment and are stored in an individual tool kit kept in the area crib or central stock room when not in use. Care should be taken to keep these items from rusting. They should be cleaned regularly. Moving parts should be kept well oiled and cutting edges sharpened. A well stocked tool kit would include the items listed in the accompanying tool inventory check list.

Shop tools consist primarily of the heavier type of equipment furnished by the plant, such as pipe tools, vises, power tools, hoists, ladders, and scaffolds which are generally stored in the central stockroom and requisitioned to the crew. If the plant setup warrants duplication of the more necessary items, these may be distributed among the various stock cribs according to the specific demands of the area serviced.

Special Purpose Tools are for specialized use only and may represent only a small fraction of the tool stock. For example: plants with pole line feeders need lineman's tools; plating plants would need special equipment to facilitate repair and replacement of busbar systems and maintenance of generators; plants with extensive high bay lighting would need telescoping scaffolds, crows nests or crane bridges for servicing the equipment.

INSTRUMENTS

Electrical instruments are just as definitely maintenance tools as the electrician's pliers, wrenches and other equipment. In fact, instruments are the stethoscopes of the electrical maintenance department and constitute the backbone of a "preventive maintenance" program. With them the mechanic can diagnose the

TOOL INVENTORY

A Check list of tools for electrical maintenance

Mechanics Tools

Pliers - cutting, diagonal and channel lock types
Screw drivers - set of 3-, 6-, and 8-inch insulated type
Wrenches - crescent adjustable type, set of open end and socket type, two small pipe wrenches
Hammers - ball peen, carpenter and wood or plastic mallet
Heavy pocket knife
Wire stripper
Folding ruler - 6-ft.
Steel tape - 50 ft.
Hand drill with set of twist drills and wood bits
Hacksaw frame and blades
Small level
Center punch
Cold chisels
Assorted star drills
Assorted files
Reamer
Small alcohol torch
Test lamps
Assortment of nuts and bolts
Flashlight

Shop Tools

Portable vises and stands
Three-way stocks and dies
Ratchet stocks and dies
Pipe cutters
Pipe cutting and threading machine (preferably portable type)
Conduit hickies
Hydraulic pipe bender and shoes
Power drives
Power saw (hacksaw)
Pipe wrenches - 24-, 36-, and 48-inch sizes
Knockout cutters or saws with mandrels
Electric drills and hammers

Bolt stocks and dies
 Metal punches, collars and dies
 Bolt cutters
 Assortment of tap drills
 Hand bar shears
 Gas torches
 Soldering irons
 Reel jacks and wire reels
 Gas furnaces
 Metal pots and ladles
 Wire meter and stand
 Comealongs and cable grips
 Fish tapes and ropes
 Blocks and tackle
 Chain hoists
 Hand or power operated winches.
 Dollies for handling equipment
 Grinding wheels
 Ladders - step, "A", and extension types of various sizes

Portable Instruments

Ammeter - a.c., d.c., clamp-on type
 Ammeter - a.c., d.c., laboratory type, indicating and recording
 Voltmeter - a.c., d.c., clamp-on type
 Voltmeter - a.c., d.c., laboratory type, indicating and recording
 Instrument shunts
 Instrument current transformers
 Instrument potential transformers
 Wattmeter - single and polyphase type, indicating and recording
 Watthour meter
 Watthour meter - integrating type
 Demand meter
 Power-factor meter
 Industrial analyzer - combination of several instruments for checking a.c. circuits.
 Megohmeter
 Groundometer - ground resistance measurement
 Frequency meter
 Sight meter - for reading illumination intensities
 Tachometer
 Multipliers, resistors and standards

condition of any part of the electrical system and, by analyzing the test data obtained, take steps to prevent system breakdowns, reduce current waste and increase production efficiency.

The type and number of instruments required depends upon the size of the plant and the complexity and diversity of the electrical system. Basic instruments include the following: ammeter, voltmeter and wattmeter of sufficient range to measure the smallest and largest quantities of current, voltage and power handled by the electrical system; also megohmmeter for measuring insulation resistance. These are the "musts" of the instrument stock. The split-core or clamp-on type of ammeter and voltmeter are especially convenient for checking circuits while equipment is in operation, and should be a part of every instrument stock.

Reference library - Although not normally considered as such, reference literature is an important tool of electrical maintenance. Much valuable background material can be gleaned from books and periodicals that will prepare the individual for his specific job and keep him abreast of new developments. The library should contain textbooks on the theory and application of electricity; design and operating characteristics of electrical machinery; application, maintenance and repair of electrical equipment; theory and application of new electrical developments; and the National Electrical Code. Manufacturers' catalogs, trade literature and technical trade publications keep the individual informed of the latest developments in his field.

MAINTENANCE RECORDS

The paper work of electrical maintenance can be resolved into five major categories: electrical system plans and details; machinery and motor records; system survey test data; material inventory records and maintenance cost data.

Electrical system plans eliminate confusion and uncertainty when identifying feeders, sub-feeders and branch circuits for test purposes; for revamping or extension of the system; for making system surveys. A good set of electrical plans should be on file.

Motor records provide invaluable finger-tip information. They are the case histories of the motors. Keep records of this type on printed file cards. Use a separate card for each motor.

Test data secured in the various periodic system surveys outlined in the attendant list should be recorded on special forms developed for this purpose, or incorporated in modified feeder and equipment schedules providing added space for this information. Definite inspection periods for each type of survey should be set up and followed carefully.

Material inventory records are necessary to assure a minimum stock of repair and replacement parts for normal maintenance

Electrical Maintenance PLANNING

and any emergency shutdowns anticipated under normal operating conditions. The complexity of this record and the method of filing will depend upon the size of the plant and its system.

Cost records are the ones in which management is primarily interested and hence are an important phase of maintenance department paper work. These are compiled from the daily work orders and job reports of the maintenance crew and represent the number of hours and quantity of parts employed in normal maintenance — testing, checking, cleaning, making minor repairs and adjustments to particular phases of the electrical system. Minor and major emergency work should be handled as separate items since such differentiation will facilitate the development of time and spare parts factors to be earmarked for future emergencies. System extensions and alterations also should be kept separate as these do not constitute normal maintenance of equipment but might fall under the heading of capital investment.

CONTRACT MAINTENANCE

The acute shortage of skilled manpower, and three shift, seven-day per week operations has caused some plants to seek outside help. In most industrial areas there are electrical contractors and motor service organizations who have the technical personnel, skilled manpower, experience and equipment to do a thorough and reliable job. Some of the larger plants have transferred their "wiring crews" over to routine maintenance and given their electrical system alteration and extension work to contractors. Most plants send their motors to motor service shops for repairs and many contract their elevator maintenance work.

Contract maintenance is the logical solution for the smaller plants in need of larger maintenance facilities. It avoids the capital outlay for tools, instruments and equipment and time lost training inexperienced help.

The definite advantages of contract maintenance claimed by contractors specializing in industrial maintenance include:

1. Skilled manpower and engineering talent now in the employ of contractors can be diverted to the maintenance of equipment and systems they have been installing.
2. Economy of equipment — one contractor can service and maintain a dozen or more average plants with his equipment. Otherwise at least 12 sets of duplicate equipment would be needed.
3. Emergency standby — contractors have the tools, materials and men to handle plant emergencies most efficiently. Only a minimum crew and equipment would be necessary in the plant at all times.
4. Reduction of paper work, which can be handled by the contractor.



CARE OF PORTABLE GRAPHIC METERS

(Recording)

To keep meters in good working order:

- 1** Eliminate rough handling.
- 2** Protect them from excessive moisture, dust, corrosive fumes, severe vibration, or extremes in temperature.
- 3** Always empty inkwell before moving a portable instrument. Spilled ink on electrical coils causes rapid deterioration of insulation causing shorts and inaccurate readings.
- 4** Occasionally wash inkwell and pen with warm water or alcohol to avoid inking difficulties. When used at temperatures below freezing, dilute ink with alcohol.
- 5** Use ink supplied by instrument manufacturer.
- 6** Keep charts dry — damp charts expand.
- 7** Thread chart through meter carefully.
- 8** Select a chart speed that will sufficiently spread out the record for clear reading and interpretation.
- 9** On a d.c. ammeter or wattmeter, use only the shunt leads supplied and for which that specific instrument was calibrated. For other instrument wiring use No. 14 or larger wire.
- 10** When connecting a wattmeter always consult wiring diagram to secure proper connections.

Types of contracts — Maintenance contracts, like those in the construction field, are of two distinct types:

1. Time and material — an agreement by which the contractor is paid for the labor and materials including or plus a percentage for overhead and profit for making prescribed inspections, surveys and repairs.
2. Straight contract — an agreement in which the contractor will, for a predetermined lump sum price, maintain the entire electrical system or any prescribed portion thereof in first class operating condition for a specific time period (usually one year) and to make any necessary repairs.

Both types of agreements have been used in maintenance work and the choice is a matter of preference on the part of the management and the contractor.

Scope of contracts depends upon the existing maintenance setup at the plant and may range from total maintenance to partial system maintenance. Contracts may cover:

1. Complete system maintenance—including service and distribution facilities, motors and controls, lighting equipment, and all necessary surveys, inspections, replacements and repairs.
2. Motors and controls only — including periodic oiling, testing, cleaning and repairs and rewinds when necessary.
3. Service and distribution equipment — including transformers, feeders, switchgear, panelboards and branch circuits.
4. Lighting system — particularly servicing of lighting fixtures including periodic cleaning, group lamp replacements and checking of equipment to preclude burnouts.
5. Low tension systems — including intercommunicating telephone and signal systems with particular emphasis on instruments, relays and contacts. This type of contract is generally handled by contractors specializing in this field.

Supervision of a contract maintenance program is the direct responsibility of the contractor. He decides the frequency of inspections and test surveys; the type of repairs needed; the geographical itinerary of his men to conserve time, gasoline and rubber in making plant trips. The "outside" maintenance crew follows his instructions and sends daily reports to his office.

Paper work for contract maintenance is entirely in the hands of the contractor. His office transposes data from daily reports of the men directly to the individual plant records, including such items as repairs, time, materials, and test survey data. If analysis of reports indicates the presence of impending electrical trouble, the contractor working on a straight contract will take immediate steps to remedy the condition. If he is working on a time and material basis he will notify the management of the condition and it is then their responsibility to authorize the necessary repairs.

Electrical Maintenance

C M P

The Controlled Materials Plan which guides the movement of practically all critical materials provides for both production and materials scheduling. Under its rules the end products and the necessary materials are timed to meet fixed schedules.

Material schedule responsibility rests with Claimant Agencies: the War Department, Department of Agriculture, ODT, Lend-Lease, etc. Scheduling is accomplished by applications for allotments and allotment numbers issued to assure that materials and parts scheduled will flow through on time.

Controlled Materials are steel, copper and aluminum. Class A Products are those containing any controlled materials beyond the forms specified in the CMP Materials List except Class B Products. Class B Products are specified in an official list. In electrical maintenance, the major items involved are copper wire, a "CMP Material", and other electrical products, practically all "Class B Products".

M R O

Under CMP regulation No. 5 a procedure has been established for obtaining maintenance, repair and operating supplies. Although part of CMP, it covers the purchase not only of controlled materials but of uncontrolled materials and manufactured items.

Industries are divided into three classes and are granted priorities for MRO supplies accordingly. The first group, Schedule I, may rate orders for MRO supplies AA-1. This group includes manufacturers of such products as industrial machinery, electrical products, engines and turbines, communications equipment and transportation equipment. It also includes ship repair and maintenance.

The second industry group, Schedule II, may rate MRO orders AA-2x. It includes manufacturers of such items as boilers, farm tools, clocks, lighting fixtures, drugs and construction materials and includes repair services for industrial and household equipment. All other industry groups are relegated to A-10, a rating of doubtful value but adequate for some non-controlled items.

The complete list of industries in Schedules I and II is given in the official CMP Regulation No. 5. If you do not know which rating applies to your MRO material requirements consult the official list or your WPB office.

A further regulation, CMP No. 5a, provides for rating of MRO materials for government agencies (cities, states, counties, etc.). Schedule I grants preference ratings of AA-1 to sewage disposal, hospitals, refuse collection and disposal and other similarly es-

MAINTENANCE PRIORITIES

How to apply ratings on purchase orders

1. For Controlled Materials

CMP allotment symbol MRO — (P order No.) The undersigned certifies, subject to the criminal penalties for misrepresentation contained in section 35 (A) of the United States Criminal Code, that the controlled materials covered by this order are required for essential maintenance, repair or operating supplies, to be used for a purpose listed in Schedule I or Schedule II of CMP Regulation No. 5 and that delivery thereof will not result in a violation of the quantity restrictions contained in paragraph (f) of said regulation.

2. For Other Materials

Preference rating (specify rating) MRO. The undersigned certifies, subject to the criminal penalties for misrepresentation contained in section 35 (A) of the United States Criminal Code, that the items covered by this order are required for essential maintenance, repair or operating supplies; that this order is rated and placed in compliance with CMP Regulation No. 5; and that the delivery requested will not result in a violation of the quantity re-

PRIORITIES

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strictions contained in paragraph (f) of said regulation.

Definitions

"Maintenance" means the minimum upkeep necessary to continue a facility in sound working condition, and "repair" means the restoration of a facility to sound working condition when the same has been rendered unsafe or unfit for service by wear and tear, damage, failure or parts or the like: Provided, that neither maintenance nor repair shall include the improvement of any plant, facility or equipment, by replacing material which is still usable, with material of a better kind, quality or design, except as provided in paragraph (b) (3) of regulation No. 5. "Operating supplies" means any materials or products which are normally carried by a person as operating supplies according to established accounting practice and are not included in this finished product, except that materials included in such product which are normally chargeable to operating expense may be treated as operating supplies. The term shall also include such items as hand tools, customarily purchased by the particular employer for sale to his employees for use only in his business, in those cases where they would constitute operating supplies under established accounting practice if issued to employees without charge.

sential activities. Schedule II grants an AA-2x rating for streets, airports, flood control, jails, schools and "repairs made necessary by reason of any breakdown of . . . electrical wiring or equipment . . . in any building or to provide against imminent breakdown of any such facility by Governmental agencies only".

Claimant Agencies—Plants or establishments owned and operated by a Claimant Agency must obtain maintenance and repair materials by another procedure. Controlled materials must be obtained by the use of allotments in the same manner as production materials. Other materials must be obtained through preference ratings specially assigned for the purpose.

Quantity Restrictions—The cost of MRO supplies during a quarter must not exceed one quarter of the 1942 total with the exception of a seasonal business. The ratings then may be applied up to the same expenditure as the corresponding 1942 quarter.

Where several plants or operating units keep separate maintenance supply records each shall be treated separately to comply with the quantity restrictions.

Additional Assistance—Any person requiring MRO supplies who cannot obtain them under the provisions of CMP regulation No. 5 may apply to WPB for additional assistance. If no particular form is specified by applicable WPB regulations, the request may be made on PD-1A.

Capital Equipment—Small items of capital equipment or replacement amounting to less than \$500 may be purchased under the MRO rating. Larger purchases must be handled under the appropriate "P" regulations, PD-1A, PD-200, etc.

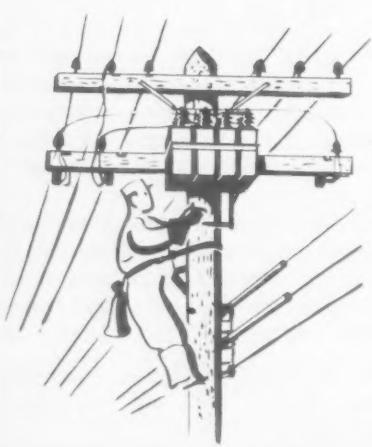
Telegraph or Phone Orders—When MRO ratings are extended by telegraph include the statement "ratings are certified pursuant to CMP regulation Number 5" (or other appropriate regulation) and confirmed by written certification. On telephone orders give the certification in substance verbally and send a confirmation within seven days.

In the event of an emergency breakdown requiring materials which cannot be quickly obtained on available ratings get in touch with your nearest WPB office, explain circumstances and rating necessary to obtain immediate delivery. A procedure is available for immediate emergency rating.

PD-1A—All PD-1A application for items of capital equipment or materials on a one time basis must be filed with the nearest WPB district office, not in Washington.

In all questions of priority ratings keep in close touch with your District Office. The trend toward decentralizing rating problems is giving field offices progressively greater authority.

Electrical Maintenance



SERVICE ENTRANCES

Maintenance of service conduits and fittings requires preventive inspection and care at about six month intervals. Where there is evidence of corrosion the conduit and fittings should be cleaned and painted. Supports and fittings should be tightened where necessary and, if there is evidence of mechanical damage, additional mechanical protection provided. Low concrete curbs, driven posts or running strips require no critical materials and can be used to prevent accidental damage.

Moisture is almost always present in service conduits, the most serious damage, however, comes from trapped water. Holes in the bottom of the lowest point or fitting will prevent this condition.

Underground services require little if any attention. Conduits should be drained to avoid trapped water and sealed where necessary at the point of entrance.

OVERHEAD LINES

Maintaining overhead lines involves protection against mechanical failure and weathering. Inspection, tightening and rust prevention will save breakdowns in bad weather. Weatherproof paint on splices makes insulation last longer. Tape and paint fraying insulation. Trim nearby tree branches. Take up abnormal slack in lines and guys.

Where practical, closer spacing will reduce reactance drop on long a.c. lines. Risers should be installed on the north side of poles to minimize direct sun rays. Pole top apparatus such as capacitors, transformers, etc. should have the same maintenance care as interior equipment.

CONDUIT SYSTEMS

The conduit, pull boxes, gutters and enclosures of the electrical system require little care, but minor defects corrected at once will prevent serious failures.

Paint exposed conduit threads to prevent corrosion, tighten loose locknuts and bushings and close unused knockouts. Inspect and tighten supports and hangers where there is vibration.

Conduit connections around machines are points to check for loose locknuts, flex fittings and cover screws. Conduits should not be used to support other mechanical parts or if they must be so used additional clamps or hangers should be installed. Materials hung from an open conduit run can place strain at the bushing.

Conduits in wet locations should be checked for moisture

KNOW HOW

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accumulation or trapped water. Small holes drilled in fittings or conduit at low points will permit drainage.

PANELBOARDS AND SWITCHBOARDS

In panelboards in which circuits are operating near rated capacity heat is normal. Rules do not allow ventilation and the only remedy, particularly in summer, is to open the door. When a circuit is operating at capacity the fuse or thermal element is at its highest temperature. This heat is carried off by radiation and conduction through the mechanical parts and the wiring.

Dirty contacts, loose connections or other points of high resistance aggravate the normal heating and should be cleared before trouble can start. Inspect fuse holders for dirt, oxidation and tension. A discolored connection often indicates a hot spot. Take it apart and clean carefully with fine sandpaper.

Knife switches require an occasional drop of oil on the sliding contacts to prevent cutting. If already cut it must be ground in again with powdered glass and oil. Bearings and wearing parts should have just enough oil for smooth operation.

GROUNDS

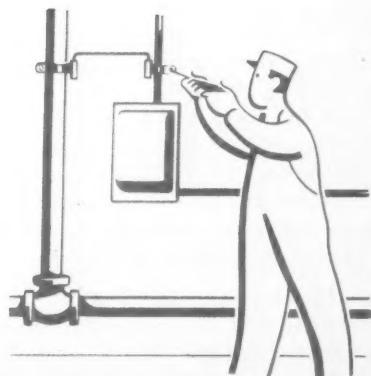
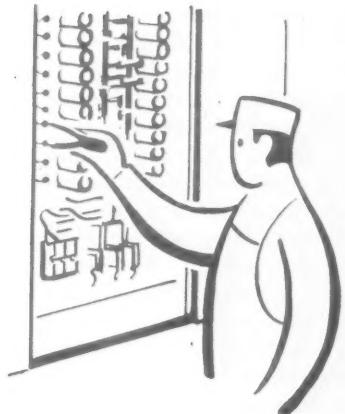
One point on every wiring system that is consistently ignored until trouble comes is the ground connection. This terminal should be carefully checked every six months or so. On most industrial systems the ground connections are large and terminate on a water supply pipe close to the point of entrance. Dissimilar metals making a junction in the presence of moisture and little attention, set up a destructive chain of electrolysis and corrosion that causes trouble only when the protection it affords is needed most.

Ground conductors should be checked for firm contact, tight lugs and tight straps or grounding fittings. Clean the connection thoroughly and lacquer exposed copper or brass parts.

TRANSFORMERS

1. Liquid level should be checked at least once a year and enough liquid added to bring the level up to the transformer manufacturer's mark.

2. Insulating fluid should be checked periodically for dielectric strength and sludging (carbonization). It should be kept at a value in accordance with A.S.T.M. recommendations. If lower values are obtained, the liquid should be either purified or replaced.



Electrical Maintenance KNOW HOW

3. Temperature should be checked daily.
4. Voltage and load condition should be checked periodically to determine that transformer is not being overloaded. This check should be made particularly when sludging is noted. Dark oil or oil with carbon particles in suspension indicate "sludging" and perhaps overheating.
5. Ventilation should be checked at regular intervals to make sure that ventilating ducts or windows are not clogged or closed.
6. Cooling tubes or radiators should be kept free of dust or other foreign material.
7. Connections should be checked at regular intervals for tightness, corrosion and unauthorized connections. A loose connection may cause excessive heating, loss of power or a short circuit.
8. Insulation resistance should be checked periodically to detect incipient failures. A megohm test is recommended each time the liquid is filtered or replaced. In dry type transformers megohm tests can be made during regular plant shutdowns or inspection periods. High potential tests in accordance with the manufacturer's recommendations are also very valuable indications of impending trouble and they may save expensive enforced shutdowns.
9. Transformers that have been flooded should be thoroughly reconditioned. Coils, core and tank must be cleaned by removing sludge and other accumulations. Insulation must be dried by infra-red lamps or ovens and tested. Liquid should be tested for moisture and if necessary filtered or dried.
10. Secondaries of instrument transformers for measuring current should be short circuited, and those for measuring voltage should be open circuited, until the values are known to be safe.

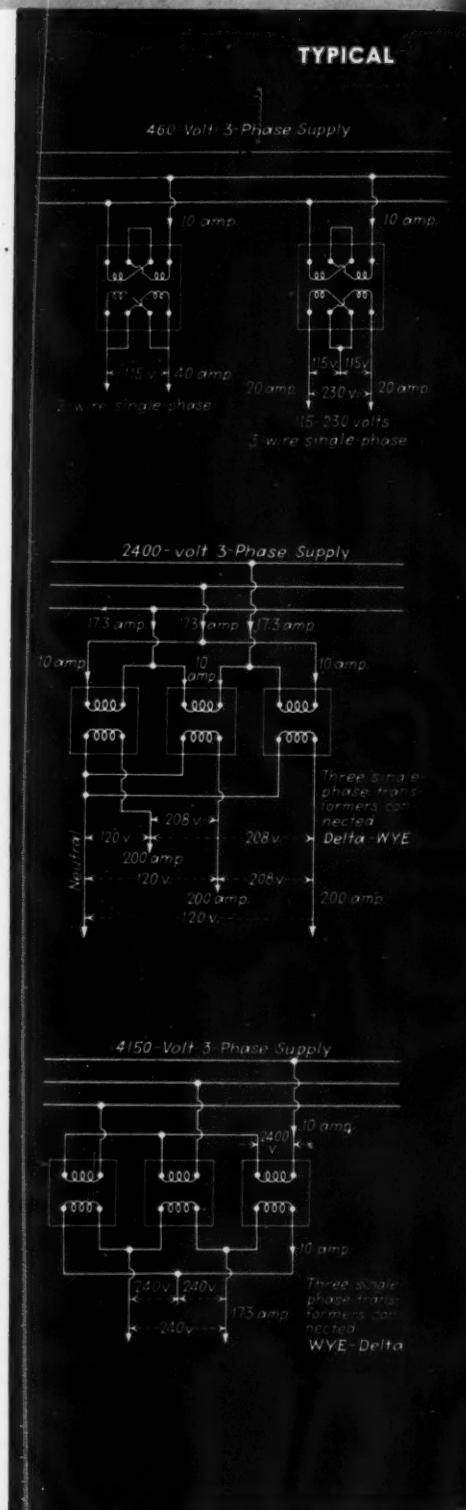
CIRCUIT CONDUCTORS

At least once a year, depending on operating conditions, test insulation resistance on all circuits. The line should be opened at both ends of the circuit. Measurements should be made between the insulated conductors as well as between each conductor and the conduit. Keep a record of the results of tests. When an appreciable drop in insulation resistance is observed, further checks must be made to determine the cause of the trouble.

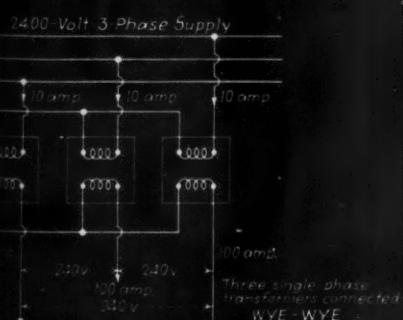
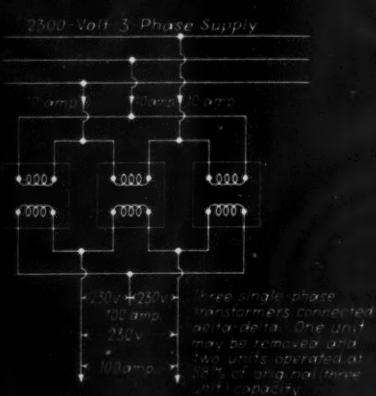
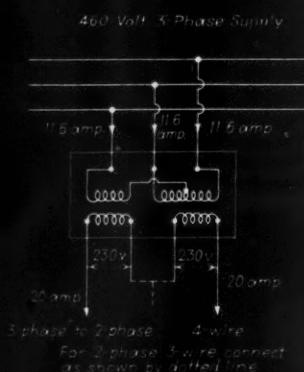
Many wiring failures can be attributed to excessive heating or overloading. After the circuit has been put in operation, a check should be made at any hot spots to determine if the operating temperature is within the limits assigned to that particular grade of insulation. Don't trust the sense of touch, use a thermometer. If the temperature of the conductors is higher than the specified limits, corrective measures should be taken immediately.

Some maintenance points are —

1. Check circuit loadings by use of an ammeter and definitely determine that the maximum loads do not exceed the safe rating of the conductors.
2. Provide sufficient ventilation for massed conductors.



CONNECTIONS



3. Inspect connections, tighten lugs or terminals.
4. Remove temporary alterations, or replace with permanent wiring.
5. See that all feeders and circuits are protected with overload devices, which correspond with NEC capacity ratings.
6. Check conduit runs for condensation and drainage.
7. See that single-conductor a.c. feeders do not cause inductive heating in clamps, conduits and metal ducts.
8. Check for vibration, also abrasion of conductor insulation from loose or damaged conduits and fittings, examine insulating bushings.
9. Check grounding connections of boxes, cabinets, conduits and raceways.
10. Examine wall bracketed runs for impact from material handling equipment.
11. Clean all insulators on open wiring and buses.
12. Check lead sheaths at ends of duct runs to see if any corrosion, electrolysis or crystallization is occurring. Wrinkling of sheath may indicate abrasion against edge of duct.

For wiring changes and emergency hookups a supply of assorted pressure connectors in the trouble kit speeds the job. Connectors should be socked up tight with the right tool. Don't improvise.

CIRCUIT BREAKERS

Circuit breakers serve as disconnecting means or protective devices to take care of abnormal conditions on a.c. or d.c. circuits.

For reliable operation, circuit breakers must be inspected regularly and systematically. Frequency of inspection should be determined on the basis of the conditions of the installation, frequency of operation, magnitude of current interrupted and any unusual operations which occur occasionally. A maintenance schedule can soon be established based on operating experience.

In the care of air circuit breakers —

1. Make light monthly inspection and a thorough inspection semi-annually.
2. If breakers remain closed or opened for a long time, arrange to operate them several times every two weeks.
3. Check main contact for overheating caused by insufficient contact pressure or poor electrical contact. Overheating may be caused also by insufficient lead capacity, hot ammeter shunt too near the circuit breaker, defective contact between parts of conducting material such as nuts, clamping terminals, and busbars to the studs, or a defective soldered joint.
4. See that contacts have not shifted, that all adjusting screws are tight, that main contact precede opening of secondary contacts, and that contacts on multipole breakers make and break at the same time.
5. Sandpaper or file pitted or burned copper contact surfaces. Use crocus cloth on silver contacts.

KNOW HOW

6. To check contact surface, insert thin paper between contact and contact block or stud head and close the breaker. If blank spaces occur in the imprint, carefully remove the high spots.
7. Occasionally check calibration and operating mechanism.
8. Remove dust and dirt from operating parts, also check for binding in closing or opening operation.
9. Renew flexible shunt if arcing occurs between main contact and block, or main contact brush and lower stud head.
10. Check and adjust contact pressure to manufacturer's rating.

In the care of oil circuit breakers —

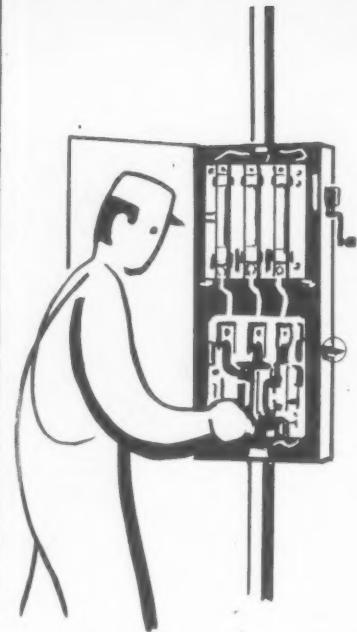
11. Be sure that the breaker frame is well grounded.
12. Examine all contacts regularly and especially after severe short circuits. See that contacts are aligned properly and that contact surfaces bear with firm and uniform pressure. Copper contact surfaces that are only roughened may be smoothed down with a fine file or sandpaper. Replace badly pitted or burned contacts.
13. See that secondary arcing blocks, if used, make contact on closing before the primary fingers.
14. Inspect bushing supports as vibration, due to operation of breaker, may cause bushings to move slightly and result in misalignment of contacts.
15. Clean bushings regularly where abnormal conditions prevail, such as salt deposits, cement dust or acid fumes, to avoid flashover.

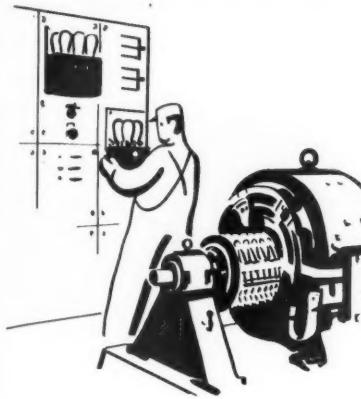
CONTROL EQUIPMENT

The care of control equipment is vitally important, requiring inspection, cleaning, testing, replacing worn parts, overhauling and stocking of renewal parts.

One maintenance job is to determine the reason for shut down or non-operation of the control and to correct the trouble. If a motor does not operate properly when a pushbutton or other control device is operated any of the following may apply; overload, defective wiring between motor and control, defective control apparatus, defective motor or abnormal line condition.

Some of the symptoms and remedies for a.c. and d.c. control troubles are— if control devices do not close trace power source; renew faulty fuses; check power-voltage supply; if chronic, check wiring adequacy; examine and tighten connections; check for broken wiring or open connections located with test equipment and repair. If control devices do not open check stop control circuit; for circuit defects trace with test equipment and repair. If operation is sluggish adjust for proper tension; check power voltage and supply circuit conditions; correct mounting position; for excessive friction test movement by hand for free swing; clean pivots; align parts. If there is an excessive collection of dirt and grime for high humidity use oil-immersed control; for extremely dirty atmosphere use oil-immersed control or dust-tight enclosures; for oil on control devices clean and do not re-oil parts; for excessive condensation





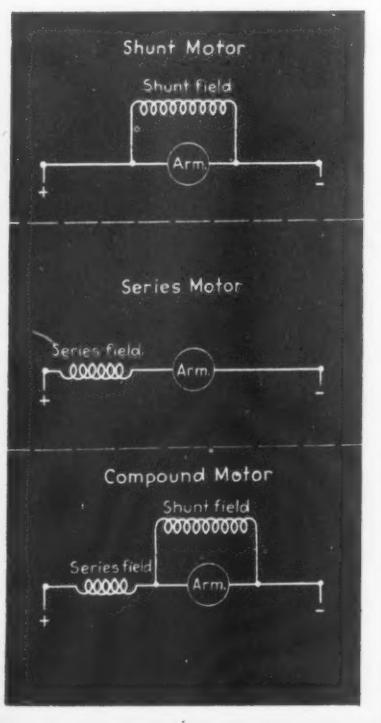
avoid rapid temperature changes; use oil-immersed equipment. If control coils overheat during operation replace with new coil; apply larger control; relocate control; use forced ventilation; for loose connections examine and tighten, check for undue vibration or rapid temperature changes. If control contacts get too hot replace worn contacts; adjust or renew old springs; check load and apply correct size contactor; clean and smooth contacts; apply larger control device; adjust or renew arc chutes. If excessive arcing at contacts during operation adjust arc chutes; renew if worn; adjust spring pressure; remove excessive friction; check connections. If contacts pit or corrode clean and adjust; check load and use larger size; enclose control, in extreme cases use oil-immersed contacts; change or improve mounting to stop vibration. If contacts of control device fail to complete circuit clean and dress contacts; if caused by chemical fumes or salty atmosphere replace with oil-immersed control; renew contacts; check spring tension; check circuit wiring.

DIRECT CURRENT MOTORS

Brush inspection is important. If brushes are broken or show considerable wear, they should be replaced with new ones. Commutator inspection can be made at the time the brushes are inspected. The main thing is to see that the surface is smooth.

Sleeve bearings require frequent inspection to check oil level and to make sure that the oil rings turn with the shaft. Ball bearings are usually supplied with sufficient grease for about one year's service, based on an 8-hour day operation. Bearing chambers should be not more than half filled with grease.

Some of the symptoms and remedies are — if motor will not start close switch; replace fuses; repair broken wire; replace frozen bearing and clean shaft; reduce load or use larger motor. If motor starts and then stops check load and reduce if necessary; check fuses and overload relay; check control contacts. If motor starts in opposite direction reverse armature connections; check if last connections were inadvertently reversed at switchboard or elsewhere; reverse shunt field connections. If motor runs too slow remove excess load; look for metallic contact between commutator bars and remove; test for internal short and repair armature. If motor runs too fast make clean and tight connections; decrease resistance; set brushes correctly. If motor vibrates balance armature; balance or replace pulley. If sparking occurs at brushes true up commutator; undercut mica; replace brushes; reset brushes; let down high bar on commutator with mallet and tighten clamping ring or grind or turn down to level of other bars; measure resistance of each coil and replace coil having lowest resistance. If brushes wear rapidly smooth commutator; use correct grade. If commutator is hot replace with correct grade; decrease spring pressure; reset brushes. If armature overheats remove excess load; test for internal short and repair armature; test and repair broken circuit.



Electrical Maintenance KNOW HOW

ALTERNATING CURRENT MOTORS

The maintenance of a.c. motors includes inspection, cleaning, lubrication, testing, replacement of worn parts, overhauling and proper storage of spare parts.

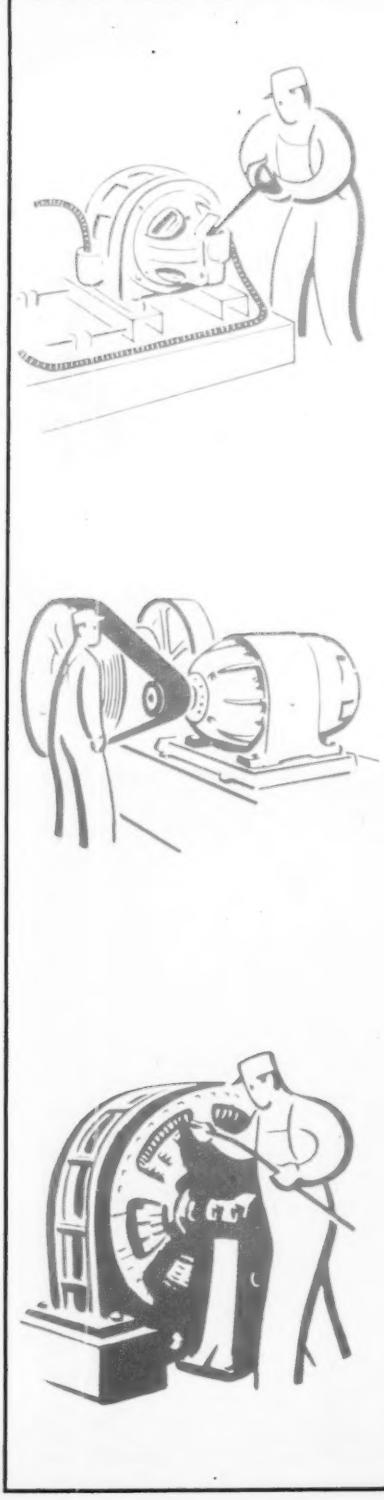
Weekly, semi-annual and annual inspections should be made. The frequency of the inspections can be varied to suit actual plant conditions.

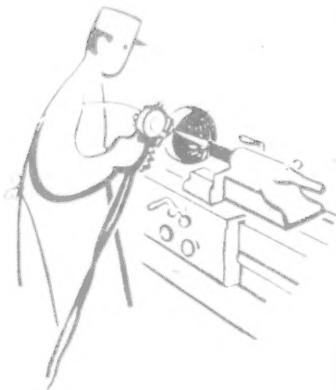
When motor does not start check driven equipment to reduce load; renew fuses; adjust relay switch, starter, pushbutton; check control for condition of grids, relays. If motor hums but does not start check leads and connection for open lines; lighten load. If motor starts and then stops check load, fuses, overload relay, control. If motor does not come up to speed increase voltage if possible; reduce load if possible; correct relay operation; check driven equipment, with view to unloading; adjust rotor starting resistance; check lines and connections for open leads. If motor overheats during operation reduce load; supply external blowers; use motors with greater capacity; clean motor with dry compressed air; check for open leads or connections; change fans or rotation; check for high resistance; replace worn bearings. If motor vibrates after repairs have been made realign; make foundation solid; balance coupling; rebalance driven equipment; replace bearing; adjust bearing or add washer. If stator coils are too hot reduce load; test with wattmeter and repair; check connections and for high resistance; check with voltmeter and lower or raise voltage.

Long bearing life may be assured by keeping foreign matter out of the oil reservoir and by maintaining proper belt tension, machine alignment and good lubrication. Lubrication of the three commonly employed bearings — sleeve, ball and roller types — requires slightly different methods. Sleeve bearings require frequent inspection. About every six months the oil reservoir should be flushed out with solvent and refilled with fresh oil. Ball and roller bearings are usually supplied with sufficient grease for one year's service, based on an 8-hour day operation for most applications. Grease should be changed annually on periodic inspections, it should be determined that grease has not been forced out of the bearings. Ball bearings require only a small amount of grease. Any appearance of oil or grease along the shaft exterior to the bearing should be promptly investigated.

Overloaded motors attain high temperatures reducing the insulation life. Ordinarily, open motors are insulated with Class A insulation, which will begin to roast when a temperature of 95 deg. C is maintained. Any condition which produces flame, smoke, or even a pronounced odor should be immediately investigated.

Single-phase operation of polyphase motors, too much bearing clearance, uneven air gap condition, bent shaft and poor motor alignment, are frequent causes of vibration and require correcting. In direct-connected machines, vibration may be transmitted from the driven machine to the motor. In extreme cases the motor





brushes may vibrate and greatly affect motor operation. Or the rotor might rub on the stator, short circuiting the laminated punchings and causing local hot spots.

Temperature indicators can be mounted on frames of motors, on bearings; and with suitable leads extended to the windings. They facilitate loading and indicate approach to danger zone for over heating.

VENTILATION

Maintenance of motors and control for fans and blowers includes monthly inspection, lubrication, servicing, etc. as required for similar equipment on other machines in the plant.

On other parts of the ventilating system, maintenance consists largely of keeping the various accessories in operating condition. Filters, washers, heating coils, etc. should be cleaned and inspected at regular intervals.

Where greasy, moist or dust laden air is being handled, the blower should be inspected for accumulations in the bottom of the housing, or on the blades where it will cause the wheel to become unbalanced. The presence of a quantity of these obstructions to the free flow of air through the blower wheel and housing or other parts may seriously reduce the capacity and efficiency of the system.

Maintenance of the air handling circuit of an air conditioning system is somewhat similar to that of a ventilating system. This circuit includes equipment such as blowers, fans, dampers, ducts, filters, heating and cooling coils, washers, motors and control.

The refrigerant circuit includes compressors, condensers, evaporators, pumps, valves, piping, motors and control. For this equipment a definite maintenance routine is as essential as for any other apparatus or device.

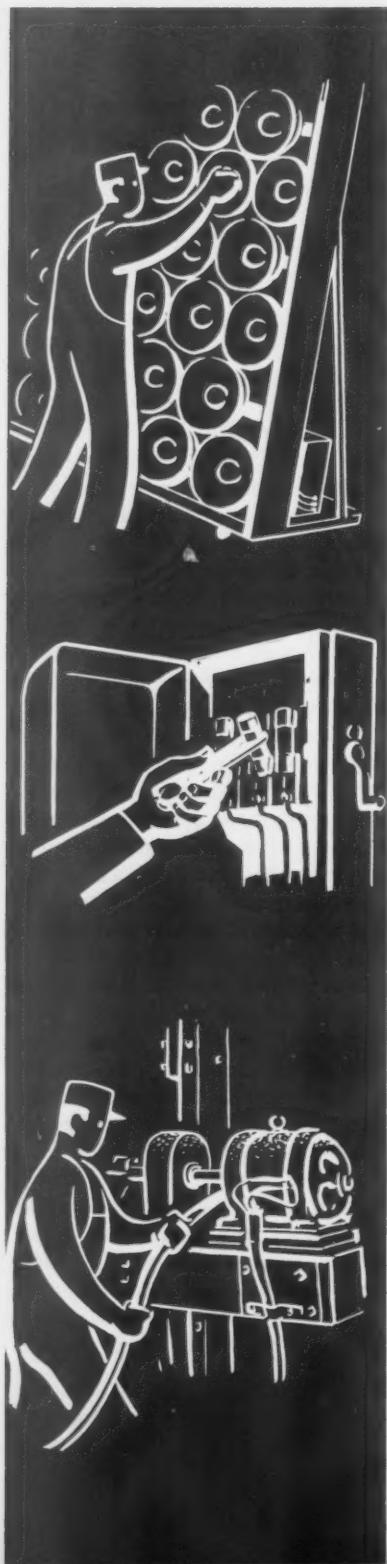
Compressors, coils and refrigerant piping should be checked periodically for leaks.

Oil pressures and pressurestat settings should be checked on forced-feed lubrication of compressors. Condensing water should be analyzed at least once a year and should have a pH value of from 7.5 to 8.5 to keep scale formation at a minimum.

All electrical equipment of an air conditioning system requires inspection and servicing at least once a month. Motor bearings, brushes, air gaps, and commutators must be checked, as well as line voltage and insulation resistance. Starter contact tips and fingers require adjustment. Electrical connections must be kept tight.

ELECTRIC HEATING APPARATUS

Electric heat has definite advantages well recognized by industry. Its numerous applications have brought about the development of a diversity of electric heating units and equipment. However, they



may be divided roughly into four classes — small heating units, ovens, furnaces and infra-red apparatus.

Maintenance of small heating units calls for the following points to be checked; (1) Make periodical tests for wattage that is developed in comparison with the original installed capacity. (2) See that there is no excessive voltage drop between power source and heaters; (3) Periodically clean heating surface of immersion heaters to prevent formation of coating of boiler scale or carbonized material. (4) Make voltage tests at heater terminals. Electric heating units should not be installed where line voltage is more than five per cent above rated voltage of the heater. (5) Keep in stock several spare heating units of each type in general use, where production must be maintained without interruption.

The maintenance of electric ovens requires: (1) An occasional touching up of relay points and contactor tips if loaded near capacity; (2) a monthly inspection of heaters to see that (a) connections are tight, (b) sufficient electrical clearances are maintained, (c) no foreign objects are present to cause short circuits and (d) oven is clean and free of drippings.

The following points should be checked to keep furnaces in operating condition. (1) See that voltage is reasonably close to nameplate rating. (2) On a definite schedule, check or replace thermocouples and inspect control instrument. (3) Keep contactor tips in good condition. Contactors open full line current many times per day. (4) Inspect connection between heating unit terminal and cable connector every six months. (5) Keep terminal outlets packed at outer wall. Air entering or escaping around terminals increases heat losses. (6) At regular intervals, inspect all furnace doors to insure that they are in good condition and sealed properly, so as to keep door heat losses to a minimum. (7) Carry spares for parts that may need replacements. (8) If the work is dirty or scales while in the furnace, periodically take up hearth plates and clean out all scale and dirt. (9) Hearth plate life will be increased by uniform loading and keeping thermal shock to the hearth plate to a minimum.

Infra-red equipment requires a maintenance routine similar to that used for the lighting system. Reflector should be cleaned regularly. Lamps should be kept free of dirt and deposits of vapor borne paint or lacquer.

EQUIPMENT FOR HAZARDOUS LOCATIONS

Maintenance of electrical equipment used in hazardous locations is important. Inspections and servicing is similar to that required for equipment used in "ordinary" locations. However, as apparatus and fittings are designed and constructed to meet specific conditions and the standards of Underwriters' Laboratories, additional attention is necessary. Special points to be covered are:

For Class I locations —

1. Printed instructions and cautionary statements on nameplates of apparatus and fittings are to be strictly observed.
2. No attempt should be made to enter any device or enclosure before the circuit is broken at some point ahead. Removal of a cover while the circuit is alive is an invitation to disaster.
3. Before replacing cover, all extraneous dust and grit should be wiped from ground surfaces and a light mineral oil film put on to prevent rusting.
4. All metal-to-metal surfaces must be free of dents or nicks as these tend to hold the cover away from the enclosure, thereby allowing flame from an internal explosion to escape to the outside.
5. The same care that is taken in machining and assembling the equipment at the factory should be observed in maintenance.
6. Covers must be reset in position and firmly fastened by screws or bolts provided.
7. Lost or worn screws must be replaced as any unfilled or loose screw openings may cause failure.
8. Screw covers and rigid conduit connections must have perfect threads and be screwed tightly so that at least five full threads are always in contact.

For Class II locations —

1. A daily check should be made to keep all equipment free of dust collections.
2. Covers must be closed tightly.
3. Adjustments and repairs should be made when the atmosphere is not heavy with dust in suspension.

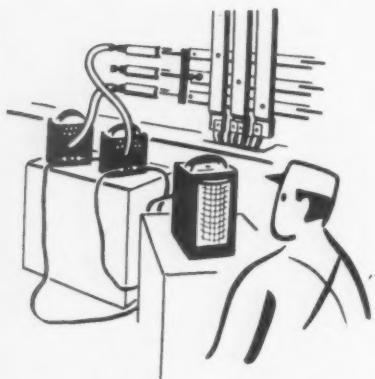
MAINTENANCE OF LIGHTING

Maintenance is the backbone of good lighting operating efficiency, and we must make the most of what we have. A successful program requires a highly organized plan of systematic inspection, cleaning and relamping. Such a program should include:

1. A complete set of records with data compiled from a periodic check up of the entire lighting system.
2. A cleaning schedule for systematic washing and reconditioning of lighting fixtures.
3. A lamp replacement and inspection schedule for periodically replacing lamps that are approaching the end of their rated life.
4. A painting schedule for periodically repainting the building interior together with contrast painting of process machinery.
5. Recommendations for the installation of equipment and devices to facilitate fixture and system maintenance.
6. Periodic inspection of the distribution system including load and voltage checks to maintain system efficiency.
7. A spare parts stock including a reasonable number of spare lighting units, lamps, parts and accessories.



Electrical Maintenance KNOW HOW



SERVICING FLUORESCENT LAMPS

If a lamp does not light or glow at the ends. Twist the lamp slightly with the current "on". Substitute a starter from a lamp that is operating properly. Substitute a lamp that is operating properly. Trace the wiring for open circuits on both line and lamp side and compare connections with wiring diagram on ballast. Check the line voltage.

If a lamp glows steadily at both ends but does not start. Substitute a starter from a lamp that is operating properly.

If a lamp glows at both ends and flashes intermittently but does not start. Substitute a starter from a lamp that is operating properly. Shield lamp from drafts or enclose it to conserve heat; if flashing continues raise line voltage and if necessary use a thermal type starter.

If the lamp arc swirls or spirals. Check the line voltage. Continue to operate the lamp. It will usually clear up the arc in a few hours. Turning the lamp off for a few seconds will frequently stop the swirling. The lamp should be replaced if the condition persists.

If a lamp flashes "on" and "off". Install a new lamp. This is the normal condition of failure when the supply of emission material on one or both cathodes is depleted. Such a lamp should be removed promptly in order to conserve the starter and avoid overheating the ballast. Shield lamp from drafts or enclose it to conserve heat; if flashing continues raise the line voltage and if necessary use a thermal type starter.

If a lamp blackens prematurely at the ends. Avoid frequent switching if possible. Check the line voltage. Check the wattage rating of auxiliary with the wattage rating of the lamp. Check the current in the lamp circuit to compare with rated current.

TOOLS AND INSTRUMENT MAINTENANCE

Good tools deserve good care. Cutting pliers should not be used for hammering nor used to hold pieces of metal in a flame for heating. Temper drawn from tools may render them useless. Never extend wrench handles to increase leverage. Use larger tools. They are designed to stand safely only the strain which the average man can apply without the use of these extensions.

Don't try to twist heavy wire with small long-nosed pliers. Use a sturdier pair. Don't rock pliers sideways when cutting; ring the wire. Cutting edges should not be filed or ground. Touch them up with a carborundum stone. When using an adjustable wrench, turn in the proper direction so as to put the greatest load on the solid part instead of the sliding jaw. Keep them well oiled to prevent rust.

Screw drivers are designed to drive and back out screws. They shouldn't be used as pinch bars or chisels. Nor should they be

placed in a flame or hot solder. Use the proper size screw driver. Too small or too thin a tip not only slips out of the slot, but also burrs the screw head and twists the tip. Use a fine cut file to keep tips properly shaped. Burrs and mushroom heads should be removed or ground off chisel heads.

Never use a file without a handle. Keep them apart from other tools that may rub or knock against them, dulling the cutting edges. Keep dry to prevent rust and corrosion.

To prevent slippage, wire grips must be kept free from dirt, grease and oil. Fine emery cloth will clean jaws. Use a file on jaws with caution. Clean and oil joints frequently.

Rope should never be dragged on the floor or ground. It should be carefully cleaned before storing. Wet rope should be dried out at room temperature and stored in a dry place. Sheaves should be kept properly aligned. Rope should never be snubbed over sharp edges of beams.

Heat is sudden death to leather safety belts especially after a wetting from water, mineral oil or acid. Dry slowly at room temperature. Keep leather pliant with treatment by a saturated cloth of neatsfoot oil every three months. Wash occasionally with saddle soap. Oil snaps and latches every two or three months.

Instruments should not be jarred, dropped or subjected to severe vibration. Should this happen, check against a standard before using. Standards should be purchased for periodic checking of all instruments regardless of how careful the handling. When checks against a standard show errors, the instrument should be returned to the manufacturer for recalibration.

Never oil the bearings on an indicating instrument; always keep the instruments clean; don't overload them nor use pliers on the binding parts. Replace broken glass lenses immediately. Corroded and defective shunt leads should be scrapped. Don't use shunt leads of improper length or size. Use only those with which the meter was calibrated. Avoid exposure to strong magnetic fields. Shield the instrument if it is to be laid on an iron surface for taking readings. Make all connections clean and tight. Avoid use in abnormal temperatures. It is very important that the secondary of current transformers should never be opened. Dangerous voltage may be obtained.

D.C. TESTING

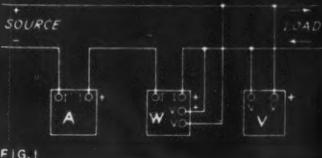


FIG. 1

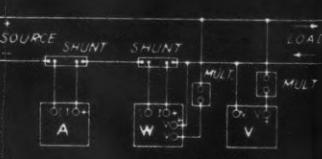


FIG. 2

SINGLE-PHASE A.C. TESTING

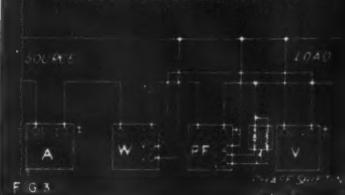


FIG. 3

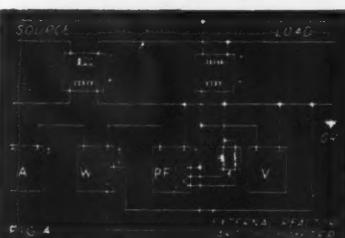


FIG. 4

A.C. POLYPHASE TESTING



FIG. 5

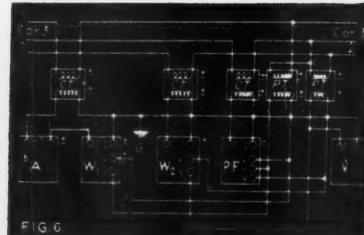


FIG. 6

A.C. POLYPHASE TESTING



FIG. 9

Electrical Maintenance KNOW HOW

PLANT SIGNALING AND COMMUNICATING EQUIPMENT



Because many of the materials and devices comprised in signaling systems are common to one or more functions of signaling, the maintenance requirements may be classified accordingly. The chief considerations are: wires and cables; terminals and junctions; power supply; lamp signals; annunciators; bells, chimes, gongs and other audible signaling devices; telephone instruments; contact making devices.

Some of the troubles and remedies in audible paging systems, bell and gong, are: if ringing trouble is general throughout system, charge or replace battery, renew fuses, or replace transformer; clean and tighten connections; adjust springs; test and correct wiring. If ringing trouble is limited to part of system, clean, smooth and adjust contacts; remove dust, lint; clean and tighten connections; replace solenoid.

For fire alarm systems, closed circuit type, if alarm bells do not ring but trouble bells ring, charge or replace battery or renew fuses; test and correct wiring; check both bell and station circuits for openings and correct. If alarm and trouble bells do not operate, charge or replace battery, or renew fuses; test and correct feeders.

For intercommunicating telephone systems, if ringing trouble is general throughout system, charge or replace battery, correct or replace battery eliminator or transformer, or renew fuses; test and correct wiring; adjust bells. If talking or hearing trouble throughout system, charge or replace battery, correct or replace eliminator or renew fuses; test and correct wiring. If talking circuit is noisy throughout system, test and correct circuit; reduce voltage to proper value; clean and tighten all connections. If more than required number of stations called at same time, test and correct wiring; inspect thoroughly for defective insulation of section wires at damp places, causing short circuit or ground; provide free movement for pushbuttons or renew contact springs.

Sound systems. Most troubles (90 percent) are traceable to the tubes. Replacement sets for outlying stations and factory recommended replacements for central amplifiers are consequently the most important replacement parts. Where extensive sound apparatus is used, a tube tester will prove useful.

Direct current and some a.c. sets require correct polarity. Mark power plugs and receptacles with paint to indicate correct position. Sound line maintenance is similar to other low voltage circuits. Examine and clean moving contacts occasionally. Make sure all screw connections are tight. Use lugs wherever possible.

Noise or hum may be picked up from electrical apparatus or bad wiring. Shielded two wire cables with shield grounded and the transposing effect of twisted pair wires will prevent or cancel out hum pickup.

Large paging or music systems with an output of 100 watts or higher have high voltage plate supplies. Never work on such apparatus without disconnecting the power.

Timely tips
from
the Wartime
Lighting Front

Salesgram

BOB BISHOP
SALES MANAGER

SYLVANIA ELECTRIC PRODUCTS INC.

Salem, Mass.

Incandescent Lamps
Fluorescent Lamps
Fixtures, Accessories
Radio Tubes
Electronic Devices

THE FUTURE OF FLUORESCENT LIGHTING is something to conjure with. It's a natural for the postwar home in the coming plastics, light-metals and electronics age. Just take a look at any of the recent magazine articles on the postwar home. Architects and designers are thinking in terms of fluorescent, the most efficient lighting known. Victory will bring a market as big as the world!

TODAY A SYLVANIA LAMP GIVES SEVEN TIMES THE LUMEN-HOURS FOR THE SAME MONEY SPENT ON FLUORESCENT IN 1938. That's why cool, shadowless, glare-free fluorescent lighting has done so much for the miracle of American war production.

EMERGENCY REQUIREMENT. Underwriters' Laboratories, Inc. has approved 2-conductor cord in place of 3-conductor cord on fluorescent fixtures for the duration. But for operation on a circuit of not more than 150 volts to ground. Advantage to war industry is conservation of copper and rubber. Advantage also of simplified wiring since no separate ground is required.

SYLVANIA'S NEW FIXTURE OF THE FUTURE (See double spread this issue) is sure to sweep the country. One secret of its success is superb finish of the composition reflector. Special type of prime coat seals up the pores of the durable composition. With reflector efficiency skin-deep, scrutinize the complexion of the composition reflectors you select.

EXPEDITES APPLICATIONS. Regional WPB offices can now grant PD-1A applications under \$500 (formerly \$100). Speeds up process and saves time for all concerned.

AS WE GO TO PRESS, AA-4 is lowest priority rating now applicable on fluorescent and incandescent lamp purchases. Ratings of AA-5 or below for lamp purchases are now considered as "unrated." Fluorescent sockets require A-1-J or better.

NO "SHOEMAKER'S CHILDREN" AT SYLVANIA. Recently one of our plants wound up two and a half years, 3,332,000 man-hours, without a single lost-time accident. One good reason was scientifically planned lighting for top efficiency.

ACCIDENTS THAT HELP THE AXIS LURK IN PLANT SHADOWS

"WE AVOID MANY DELAYING INTERRUPTIONS

of Electrical Services
with BUSS FUSES!"

Say: PAN AMERICAN ENGINEERS, Pan American Airways System, New York, N. Y.

"In flying, failures of any kind cannot be tolerated. Every part of the ship must function correctly at all times.

"After long experience we have found BUSS fuses give dependable protection when needed—yet they prevent blows that might be called needless.

"Hence, in our planes we use BUSS

Aircraft fuses—and in our shops and hangars we use EUSS Super-Lag fuses because we have found that they likewise save us many delaying interruptions of electrical service.

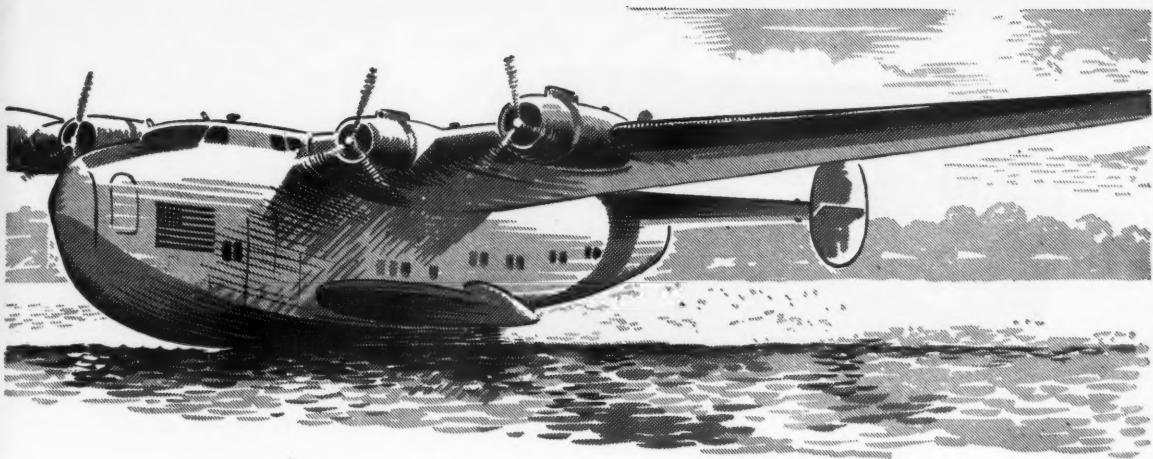
"In our opinion, BUSS fuses measure up to the high standards of protection we have set here at PAN AMERICAN."

Right—Hangar Installation of Buss Super-Lag Renewable Fuses.

Below—Panel of Buss Aircraft Fuses on a Grumman Widgeon (little sister ship of the Clipper).

PLEASE
DO NOT
WASTE TIME
OR MATERIAL





You, Too, Can Eliminate the Costly Nuisance of "False Alarm" Blows

Pan American's experience is typical of thousands of others, which proves that it isn't necessary to suffer from useless shutdowns caused by needless opening of protective devices. Properly installed BUSS fuses can be forgotten.

As for BUSS Super-Lag fuses—the experience of thousands of plants throughout all industry has proven time and again that by using them you can obtain trouble-free protection at a lower overall cost than with any other renewable fuse or mechanically operated device.

They require no maintenance or periodic inspection. They don't open needlessly. If one opens, you know there is some fault that needs correction.

Here is Why BUSS Super-Lag Fuses Greatly Reduce or Entirely Prevent Needless Blows

The fuse case is designed to insure good contact on the link, even when the fuse is renewed by an inexperienced person—and it is so designed that vibration or heavy overloads or the constant heating and cooling of the fuse will not permit poor contact to develop. Thus, excessive heat which causes fuses

to blow when they should not is prevented.

The fuse link used is the famous "BUSS SUPER-LAG." It has lag-plates attached which give it a long time-lag so that unusually heavy starting currents or other harmless overloads will not cause the fuse to blow.

And Here is How to Solve the "Shutdown Problem" in Your Own Plant

Pass the word along that all purchase records dealing with circuit protective devices should be immediately changed to call for BUSS Super-Lag Renewable fuses. Then, as fuses are replaced or new installations made, your plant will automatically get the benefit of the carefree, trouble-proof protection that BUSS Super-Lag fuses give.

BUSSMANN MFG. CO., University at Jefferson, St. Louis, Missouri, *Division McGraw Electric Company*

WHY BUSS FUSES DON'T BLOW NEEDLESSLY



BUSS Super-lag FUSES

Sold Through Wholesalers

Editorials

W. T. Stuart, Editor

Sight for Victory Needs Contractor Support

Better-Light Better-Sight has just launched a campaign which in its audacious plan and purpose can directly and effectively boost war production within a few short months. In "Sight for Victory" the important developments in lighting which our industry has so effectively applied in the great new war industries are to be carried to every manufacturing and assembly operation in the country.

Admittedly, national planning can do little more than provide useful material and draw the broad outlines. The necessary vigor and enthusiasm must be developed in local organizations, through practical and realistic committee work and through willing all-industry cooperation.

The campaign is directed especially at the small industrial plants which, though they are turning out vital war materials, have been passed by in the march of lighting progress. By showing management the production and personnel advantages to be gained, by providing competent lighting counsel and skillful application, local organizations will make an immediate and vital contribution to the war program.

Education, coordination of local interests and contact with industrial plants are, however, only the preliminaries of a plan of this scope. The real problems occur in execution. Lighting small war plants will take ingenuity in layout and wiring to affect the necessary improvement with a minimum of critical materials, for instance. Existing equipment and material will have to be effectively re-used. Priority requests will have to be drawn from a thorough understanding of the details of both lighting and wiring. Obviously the effective-

ness of the entire project will be determined by the active participation of local industrial electrical contractors at every step in the program.

Behind the Maloney Bill

The Maloney bill which would set up a new civilian requirement administration independent of the War Production Board and other war agencies has had much popular support. The general feeling that the civilian requirements are getting the leavings without regard to essential needs is widespread. And OCS has been anything but aggressive in stating its claims.

The naming of Arthur D. Whiteside to head the Office of Consumer Requirements (formerly OCS) and evidence of a very real appreciation of the home front problems in the upper ranks of WPB takes away any urgent need for a separate authority. At the same time there are powerful forces backing the Maloney measure. It had an easy time in the Senate but may hit the rocks in the House.

Beyond the very real problem of administration and manpower that a separate authority would raise, there is another side to the whole situation that has had little discussion and yet represents a dangerous threat.

WPB is essentially conservative. Its top men abhor the regimentation they have to use. Groups and individuals behind the Maloney bill represent different attitudes. Some see the civilian requirements limitations of wartime as an excellent basis for permanent consumer goods regimentation on a vast scale and as a springboard for pet social theories.

We have troubles enough without

this. The Maloney bill had a beneficial effect in strengthening WPB's attitude on civilian requirement. Let's hope that the House will now give it decent burial.

Better Maintenance Design Needed

We are still hearing reports of machine tools or other production equipment that defy routine electrical maintenance. The tendency of machine tool designers to make the most of available spaces by hiding motors and controls result in a fine streamlined appearance. But, all too often, the streamlining makes oiling and maintaining the motor or cleaning contractor tips a major operation for the electrical maintenance man. Another headache is the special motor cleverly built in to do a job that a standard replaceable motor could do just as well.

The advantage of careful design to permit ready maintenance is obvious. It means more useful machine hours. It means easy electrical repairs. The new machine tool electrical standards go a long way to assure reasonable care and reliability. It would help, however, if electrical maintenance men were more vocal in their protests.

Fix-It Operators

One of our pet peeves is the machine operator who rates himself a first class electrician. When trouble occurs, he insists that he can fix it himself and save time. His first course of action is to jam in the magnetic contactor to see if anything happens. It generally does.

To combat this situation one electrical superintendent has initiated an educational program through the foreman's meetings pointing out that electrical control is an intricate and sensitive system; that when the breaker opens, it is generally because something is wrong requiring an expert. An electrician would certainly not attempt to tell the machinist how to cut a screw or grind a tool.

Undoubtedly every maintenance engineer and chief electrician encounters the same problem with these would-be electricians. They should have orders to call an electrician even if only a fuse is to be replaced. Operators

should also have a little ground work in electrical fundamentals, at least enough to warn them of the consequences of unskilled tinkering.

Washington Comments

The victory in Africa will have a profound effect on production back home. Cut-backs in some schedules and expansion of others will bring about a considerable amount of industrial re-conversion. The attendant electrical work will compensate partially for reduced new construction.

New facilities will now require more than WPB acquiescence. They will be carefully analyzed and authorized only when there are no available buildings to take over the job. The significance to electrical work is not yet clear. The probabilities are that wiring and apparatus will be nearly the same whether needed production facilities are set up in new brick piles or old.

Relaxing of the ban against burning off insulation in scrapping wire is brought about by the emphasis on copper scrap needs. Copper wire is much more important in the scrap picture than the minor rubber scrap possibilities of its insulation.

No progress toward the disposal of MPR-251 which regulates construction prices has yet appeared. However, NECA reports that a complete amendment, which was promised weeks ago, will be released shortly completely removing electrical contracting from the regulation.

Importance of well organized maintenance for war industry is evident in the methodical elimination of priority red tape for MRO supplies. This will bring benefits in simplified procedure for contractors specializing in electrical maintenance and for harassed electrical maintenance chiefs.

Shifts in the war production requirements will hit labor hard in some areas and the job of absorbing these men into new work will not be easy. Draft requirements, however, will overshadow any relief the situation might bring.

What to do with government owned plants after the war is a question that pops up all over Washington these days. While it is still in the informal discussion stage, it's potential dynamite when labor, management and government begin to draw up post-war programs.

Back Talk

ELECTRONICS AHEAD

The gratifying response to our lead editorial "Electronics Ahead" deserves further comment. Excerpts from several letters follow. The most significant implications are:

1. That electrical contractors are aware of the profound changes that electronics will bring to their business.

2. That electrical contractors are concerned about the technical problems involved in applying and servicing electronics equipment.

3. That electrical contractors want good technical installation and maintenance data. What is the next move? We may look hopefully to the NECA postwar program as offering some of the answers. We may look, too, for the manufacturers of electronic apparatus to recognize the strategic importance of the industrial contractor and the motor shop in their distribution and service plans. In any case our industry must take the initiative.

To the Editor—"Your editorial 'Electronics Ahead' it seems to me, contains a great deal of logic and practical thinking.

"NECA started some time ago to study the possibilities for postwar work and it now has a committee working on that subject. I am calling the attention of that committee to your editorial and I am sure that it will give careful consideration to the ideas proposed by you."

Robert W. McChesney, Pres.
National Electrical Contractors Ass'n.
Washington, D. C.

To the Editor—"You can do a job for the electrical contractor, your editorial is a start. Carry on, tell us

1. What is available to sell.
2. How to learn the fundamentals of electronics.
3. What books are available on electronics."

W. J. Quinlan
Rochester Society of Electrical Contractors
Rochester, N. Y.

To the Editor—"I agree with you that electronics is going to play an important part in this industry after the war. I also believe there should be an open industrial electronics conference between the manufacturers of this equipment and the industry. It is something that is really brand new and will have a great acceptance if properly handled."

A. Lincoln Bush, Pres.
Belmont Electric Co., Inc.
New York, N. Y.

To the Editor—"I feel that it will be the duty of the manufacturer who develops this equipment to conduct lectures by men who have the faculty of explaining in simple language the technical principles involved in electronics to electrical contractors throughout the country. The manufacturer cannot provide service men nation-wide to service this equipment but will have to depend upon the contractor for this service. These lectures should be given in key cities throughout the country to groups of interested contractors and journeymen elec-

cians for these electricians are the men who will actually have to do this service work. The contractor however should have a working knowledge of this type of equipment in order to talk intelligently to his customers.

"There is no question in my mind that electronics are going to play a big part in industry after the war and this business is going to the contractor who is interested enough in the principles involved to make a study of it and thus be enabled to handle such work."

W. C. Schlosser, Pres.
Capital Electric Co.
Madison, Wisconsin

To the Editor—"I would say you hit on a very fine idea. So far electronics has been talked of in very technical language and no one seems to know much about it. The manufacturers are giving electronics a lot of publicity but very little practical information has been passed out.

"I believe your editorial will serve to wake up the people who are giving electronics so much publicity and perhaps they will come through with some practical information to fellows like ourselves. Incidentally, we are supposed to handle electronic tubes but all we have is a catalog listing the various tubes and about the best we can do is to take an order and tell the factory what a man wants to do or what tube he wants to replace, and let them furnish the proper equipment.

"It is very true, that if electronics is to take a large part in industry after the war, then the people in the trade must have more definite, concrete information concerning its application and use."

J. M. Palmer
Electrical Engineering and Construction Co.
Des Moines, Iowa

To the Editor—"Fundamental information on electronics will have to come from the laboratories and operating forces of the large manufacturers who are dealing with this subject. The applications of electronic equipment, however, will be a job for local electrical contractors, electrical engineers and local industries. I visualize a series of local conferences which will be attended by electrical contractors, engineers, distributors and industrialists, at which programs will be presented by representatives of such companies as General Electric, Westinghouse and others.

"Not only will we have to pass all available information on this subject all the way down the line in the industry to all who are able to understand it and who will take part in installing and operating it, but it will be one of those subjects which will bring the various branches of the local industry together on a basis that will promote mutual interest, mutual benefit and general goodwill. In Milwaukee we had many very excellent conferences of this kind on fluorescent lighting and I am sure our industry locally will be exceedingly anxious to get together on the subject of electronics. I have no doubt that the manufacturers who are developing electronic equipment will be prepared to pass the information out effectively to the whole industry. We will look forward with a great deal of interest and anticipate this project in our postwar planning."

F. A. Coffin, V. P.
Wisconsin Electric Power Co.
Milwaukee, Wisconsin

Methods

BRIEF ARTICLES about practical methods of installing and maintaining electrical wiring and equipment and up-to-date estimating and office practices. Readers are invited to contribute items from their experience to this department. All articles used will be paid for.

SILVER TIPPING

—INDUSTRIAL

Increased production from existing facilities has warranted rerating of those facilities, or call it overloading if you will. The pressure brought to bear by this overloading is shared equally by all parts of any integrated piece of productive machinery including the machine itself with its shafts, bearings, gears,



SILVER SHEET .012 inches thick being soldered onto the face of contactors which are undergoing more severe duty cycles. Contactor life has been increased by silvering as much as 100 to 200%. When the silver sheet has been burned or worn through it can be replaced by another.

motors, control, etc. However the strain is not as immediately apparent in some parts as in others. For instance, the contactors of the control must break larger currents than for which they were designed, and when copper contacts become overloaded they burn away more rapidly.

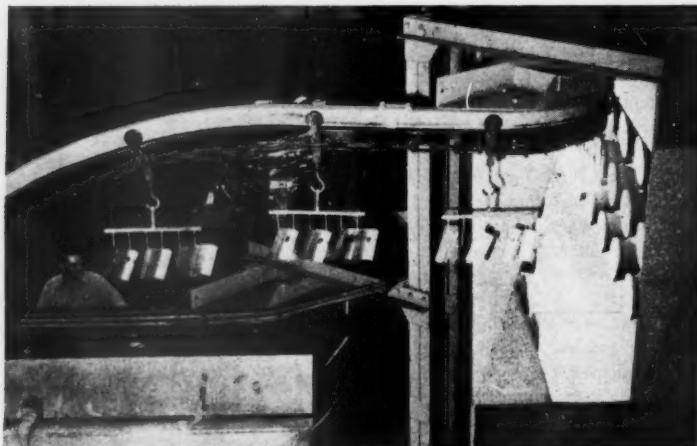
To counteract this condition, P. S. Karr, chief electrician, Armstrong Cork Company, Lancaster, Pa., has resorted to silver tipping. Whenever a contactor shows increased burning either due

to overloading or to an increased number of operations, the replacement for that contactor is silver tipped so that when the time comes for changing the contactor a silvered one is ready to put in its place. Silver sheet is kept in stock for the purpose and is soldered on by a skilled operator. Usually only one contact is silvered except where severe service conditions exist requiring that both stationary and moving contacts be silvered. Length of service life has been definitely increased and their fine performance has more than compensated for the investment.

STORED ENERGY HEATING DRIES PARTS

—INDUSTRIAL

Here is a new wrinkle in the ever increasing field of infra-red heating. Instead of drying after painting, Fleetwings, Inc., dries and heats the parts before painting. Believe it or not, the idea has proven successful.



SUB-ASSEMBLY parts (aluminum alloy) emerging from the oven and being carried down to the primer coat dip.

A few months ago, a conveyor system was installed for the application of a primer coat after parts were anodized. Key to the problem was the drying of the parts after anodizing. The trick was to quick dry the parts after washing and to keep up with the conveyor's pace. Built around the conveyor is a tunnel of 56 - 1,000-watt lamps which create a temperature of 180 F. in the parts, drying them in two minutes.

That is not all that the infra-red does. Actually the heat that dries the parts is stored in the parts themselves and in this way is carried along to speed the final drying after an intermediate dip in the primer. This is believed to be the first reported use of salvaged infra-red heat.

SETTING 90-FT. POLES

—WIRING

One unusual phase of the electrical construction encountered by the Malko Electric Co., Chicago electrical contractors, on a recent coast-to-coast radio station installation was the setting of 12 - 90 ft. wood antenna masts. This was a bit out of the ordinary since most normal line construction done by contractors involves 30 to 35-ft. poles.

Stepped pole holes, 10-ft. deep were dug, the top half being 5-ft. deep and 5-ft. in diameter, while the bottom half was 5-ft. deep with a 2-ft. diameter. This type of excavation permitted the workman to stand in the top half of the hole to dig the lower part while using ordinary post hole equipment.

While the holes were being dug, the masts were completely rigged on the ground including the installation of guy cables, pole steps, insulators, all

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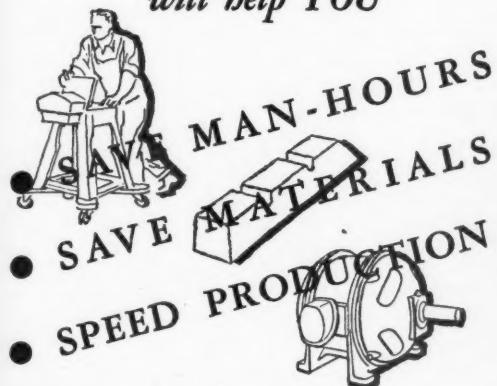
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This CONSERVATION PLAN

will help YOU



Wartime Conservation means MORE than just conserving copper, steel, aluminum... it means the most strategic possible use of all of the ingredients of Victory—materials, man power, time and ingenuity.

These five major points comprise a complete program developed by Westinghouse for Wartime Conservation. This program packages up Westinghouse engineering experience in the entire field of electric and power equipment and related materials. Examples noted are but five of many specific recommendations.

This experience and these recommendations are offered fully and without obligation. If you are not already familiar with them, consult your Westinghouse representative or send for the new 100-page book, "WARTIME CONSERVATION". It will be sent you without cost. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pennsylvania.

J-90483



Westinghouse

PLANTS IN 25 CITIES... OFFICES EVERYWHERE

943

Put this 5-point
program into action

1. Conserve

by strategic selection, application and use of electrical equipment.

EXAMPLE

Where plant power systems are carrying heavy inductive loads, capacitors release important system capacity and permit use of more motors without adding to transformer, switching and line equipment.



2. Conserve

by utilizing new developments that reduce need for critical materials and man-hours.

EXAMPLE

Hipersil*—a new electrical steel—increases the flux-carrying capacity of transformer and similar cores, large and small, up to 35%. Weight and amount of critical materials can be reduced as much as 50%.



3. Conserve

by utilizing available facilities for preventing breakdowns and machine outages.

EXAMPLE

The Westinghouse "TSL" plan for Fewer, Shorter, Longer-lasting repairs is a complete program of preventive maintenance. Westinghouse engineers will help you inaugurate this program in your own plant.



4. Conserve

by utilizing new materials which in many cases can replace critical materials and do a better job.

EXAMPLE

Presite— a new pressure-molded porcelain which can be solder-sealed to metal—is replacing bushing assemblies requiring rubber or gaskets to keep out moisture, in many types of electrical apparatus.



5. Conserve

by tapping all sources of salvageable scrap.

EXAMPLE

Systematic planning can uncover many ways of reclaiming worn equipment and waste material. Samples of salvage forms and organization charts in use in Westinghouse plants will gladly be made available on request.

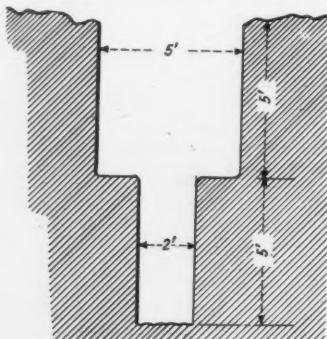


* Registered trademark, Westinghouse Electric & Mfg. Co., for High PERmeability SiLicon steel.

[FROM PAGE 86]

conduit work and the obstruction lighting. A total of six guy cables were wrapped around the pole, three slightly above the mid point and three near the top. In the interim, three twin-eye "Never Creep" anchors were sunk into the ground within a radius of 30 to 35-ft. of the pole hole. Two guy cables, one from the mid point and one from the top of the mast were fastened to each of these anchors.

A 60-ft. boom, rented for this particular work, was used to set the masts



DOUBLE-STEP pole hole for 90-ft. wood masts. Tier arrangement permitted men to dig the 10-ft. holes in wet soil with ordinary long handled post hole shovels.

in the ground. As soon as the pole hit bottom, the crew temporarily anchored the guy wires and tamped the earth around the poles which were about 18-inches in diameter at the base. The guy wires were then made taut with a ratchet type guy jack.

MECHANICAL CHARGING OF CUPOLAS

INDUSTRIAL

Where space is at a premium, and where isn't it these days, especially in war plants producing essential material, schemes and methods must be devised to use it to the best advantage.

The Allis-Chalmers' Milwaukee plant faced a problem a short time ago of how to mechanically charge a cupola to produce a better grade of iron in a shorter period. The biggest problem was to fit a crane into the cramped quarters to eliminate the hand charging method. At first, space appeared to be too cramped for a crane. However, like many other seemingly impossible problems this one, too, was solved.

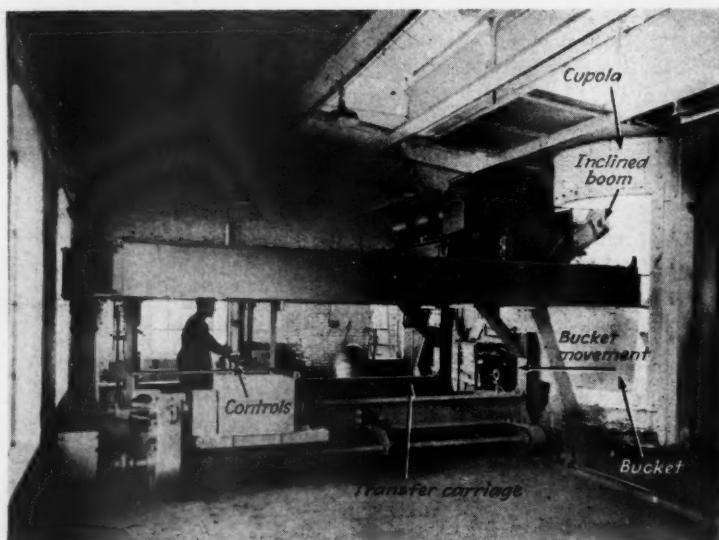
A special short-legged Whiting gantry crane was designed and installed. The crane has an inclined boom which provides room enough to raise buckets to a high position and deposit them on the wishbone casting inside the cupola shell. The rim around the top of the bucket engages the wishbone casting and the cone bottom is released by allowing the crane hook to travel downward. In this way the charge is spread all around the circumference of the cupola. The hook, by a reverse motion, returns the cone bottom to its original position and the bucket then is lifted out of the cupola and lowered to the transfer carriage.

is needed. A great many loading curves show that the load factor of most power transformers ranges from 50 to 65 percent. A large reservoir of capacity is therefore available which could be used without causing a serious shortening of transformer life.

Another item is the important problem of taking care of rare emergency conditions caused either by electrical failure or by a saboteur. In the past it has generally been considered necessary to carry a spare transformer or a spare bank of transformers to pick up the load in case of a failure. Today many users are relying on the short-time overload capacity of their transformers to carry them through rare emergency conditions. In fact, under some conditions it may be economical and necessary to use up 25 percent, 50 percent, or more of the transformer life to prevent a shutdown.

To do this intelligently requires reliable information on how to calculate hot-spot temperature, and how the life of the transformer is affected by heavy over-loads. Approximately 50 heat runs were made during the past year on three transformers of different ratings. These heat runs provided accurate data on: (1) the value of the hot-spot temperature in various classes of transformers at rated load, and (2) a practical method of calculating the hot-spot temperature with changes in the load under both ultimate and short-time overload conditions.

The rate of deterioration of insulation in a transformer is governed by the hot-spot temperature in the winding, although quite often factors other than the life of the insulation limit heavy



SINCE ADAPTING complete mechanization, with the crane as the key due to limited space, the cupolas can operate faster, produce better iron with less coke.

TAPE TAKES TO THE AIR

Bombers... fighters... pursuit planes... there's a job for tape in every one of them. And there's an even bigger job for tape in the factories that are pouring out the planes that carry the war to the enemy's homeland. It's that way all through the Armed Forces and in every branch of war industry.

Obviously, these needs are first needs and must take precedence over all others. That's why Security Tape is sometimes hard to get.

Since Security is on every front it must necessarily reach the less important jobs at a slower pace.

UNITED STATES RUBBER COMPANY
1230 Sixth Avenue • Rockefeller Center • New York

SECURITY
FRICTION TAPE
United States Rubber Company

SECURITY ON ALL FRONTS

Methods

[FROM PAGE 88]

overloads for transformers. Among such factors are contacts, leads, joints, and oil. Effect of heavy overloads on regulation must also be carefully considered.

The following general conclusions on steady state and transient temperature rises are presented:

1. For rated load conditions of self-cooled power transformers, the hot-spot rise over average winding temperature by resistance ranges from approximately 5 deg. C. upward. For moderate size and voltage rating (below approximately 50 kv.) it naturally comes between 5 and 6 degrees. But, for large size and high voltage ratings, steps have to be taken by the designer to limit the hot-spot to 10 deg. C. above average.

2. For transformers having blast rating 1.33 times the self-cooled rating, the hot-spot rise over average winding temperature is approximately 40 percent greater than that for the self-cooled rating.

3. The hot-spot rise over average winding temperature increases with load (for both ultimate and short-time overloads) but no definite rate of rise versus load can be stated.

4. The average winding rise over average oil varies as the loss raised to a power ranging from 0.6 to 0.7.

5. The hot-spot rise over top oil varies as the loss raised to a power ranging from approximately 0.7 to 0.8, generally more nearly the 0.8 power for most transformers.

6. The oil time constant used in calculating the temperature rise of the oil for short-time overloads should be based on the ultimate rise and loss for rated load conditions.

7. The winding time constant used in calculating the temperature rise of winding over oil before conditions become constant, should be based on the calculated ultimate rise and loss for the load under consideration.

8. Either load-back or short-circuit method of loading can be used to determine both hot-spot and average winding temperatures. When calculating the transient oil rises by equation, for the short-circuit method the weight of the core should not be used in deriving the time constant.

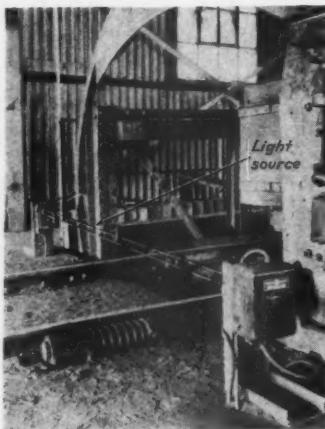
9. The temperature rise of both the average and top oil varies approximately as the 0.8 power of the loss for ultimate conditions.

PHOTOTUBE GUARDS AGAINST ACCIDENTS

INDUSTRIAL

In the coal preparation plant of the Hanna Coal Company, loaded cars are emptied by being rolled onto a rotary dump fastened to the rails by a mechanical device and then rolled upside down over a chute. After the car has been righted again, it moves off the dump by gravity.

At intervals, the plant experienced some difficulty with this arrangement. The dump would revolve before the empty car had cleared. This happened



THE PHOTOTUBE relay set up for guarding against accidents. Marked is the beam of light shooting across the tracks.

when a car took too long to move off. It is essential that the dump does not revolve the next full car until the preceding empty one has moved off. Otherwise, the empty car would be turned over onto the floor.

The difficulty was removed when a G.E. photo electric relay and light source were installed on opposite sides of the track at the empty end of the dump. Now the dump cannot revolve as long as the light beam is blacked out by the body of an empty car.

KNOCKOUT SLUGS

WIRING

Knockout slugs, which used to be given to kids who pitched pennies with them, are now put to a useful task by the man on the job. Wheeling Electric of Vincennes, Indiana collects the slugs, and when time permits, drills and stamps them M1-2-3 and L1-2-3, etc., so that they can be tied to circuit conductors for identification after they have been pulled in.

This method seems to be a marked improvement over cardboard tags which have been used quite extensively. In using cardboard or paper tags, if the marking is obliterated by dirt or grease, valuable time is very often lost in ringing the circuit out. By using these salvaged metal tags the dirt and grease can be easily and quickly wiped off and correct identification assured.

SAVING SOLDER AND TIME

INDUSTRIAL

It is only recently that high frequency soldering of parts has come into its own. War production needed such a device because it saves time, material and labor.

An excellent example of these facts can be drawn upon from the experiences of DeLaval Steam Turbine Company. This concern had parts to be made and needed them in a hurry. The old method was slow, laborious, and used too much material. The job to be done was to solder impeller blades to a turbine plate.

A new process, developed by Lepel High Frequency Labs was put to work on the job which used to take 17 hours to perform. Now, high frequency soldering saves 15 hours time on each turbine plate and 90 percent of the normal amount of solder. Each blade gets two thirty-second operations. The amount of silver solder required is measured to exact lengths which can be dropped in place before the coil fuses the blade to the plate. There is no removing of scale and no distortion of plate or blades due to excessive heat concentration on a spot as with torch brazing.

The unit generates a 1400 deg. F. heat and coils carry 250,000 cycles at 2,700 millamps.



SILVER BRAZING at DeLaval is both economical and clean. The method forms no scale or carbon and eliminates distortion of blades and plates.

MODEL ZUO-240

MODEL ZU-240

LEADER

TODAY'S ANSWER TO WAR-PLANT FLUORESCENT REQUIREMENTS

To all the advantages that have made Leader fixtures outstanding in industrial service, Leader engineers now add light weight in this brilliant new ZEPHYRLITE series.

Well under the 3-pound steel limitation, this series presents two highly efficient models which effectively meet today's demands for a powerful, economical light source in war production plants. As illustrated, the models include an open-end type and a closed-end fixture. Both ZEPHYRLITE types are available as 2-light-40, 3-light-40 and 2-light-100 units.

ZEPHYRLITE features include compact, steel-saving design; rigid, non-metallic reflectors with baked-enamel finish and reflection factor of approximately 89%; air-cooled ballast; flush-mounting without brackets; continuous row mounting; simplified installation and maintenance; and approval by Underwriters' Laboratories.

Leader products are sold exclusively through authorized wholesalers. Write for complete details today.

LEADER
ELECTRIC MFG. CORP.
832 WEST SUPERIOR STREET • CHICAGO, ILLINOIS

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I bought more than a PIPE BENDER!
My Porto-Power licks maintenance jobs, too!

Blackhawk Porto-Power Pipe Benders would still be the choice of many experienced contractors and electricians — even if the Blackhawk Bender could only bend pipe. But, Man! — bending pipe (up to 4"), and doing it well, is only part of the story!

Simple attachments can be used with the Porto-Power Hydraulic Unit—to handle tough maintenance jobs, construction work and change-overs. Write for the V-43 catalog or call your Blackhawk Distributor for more details on how Blackhawk Benders can do all this extra work.

PULL DRIVE PULLEYS AND GEARS — Smoothly, safely. No crowbars! No sledging!



LIFT MACHINERY — Raise a 10-ton load from a low of 3½" to an 8½" height.



BUILD YOUR OWN PRESS — Free blueprints! Use the powerful hydraulic unit furnished in the pipe bender.



A JACK FOR ANY SPAN—ANY ANGLE — Your Blackhawk power unit is the most refined hydraulic jack available today!



BLACKHAWK

BLACKHAWK MFG. CO.
Dept. P2063, Milwaukee, Wisconsin
Rush your new Hydraulic Equipment Bulletin V-43 to us.

Name.....

Company.....

City and State.....

Methods

[FROM PAGE 90]

PULLEY AND BEARING MAINTENANCE

INDUSTRIAL

In industrial plants where sleeve bearings are periodically pulled for re-babbiting or renewal, or where a change of drive requires the substitution of pulleys, much time is often lost unnecessarily. Each minute lost in changing bearings or swapping pulleys means lost war production. E. J. Cofrancesco, chief electrician of A. C. Gilbert Co., New Haven, Conn., has found that by machining the bearings and pulleys to more liberal tolerances so that a good healthy hand pressure will install or remove the piece, maintenance time can be cut considerably.

Where closer tolerances are employed on the outside diameter of bearings and the inside diameters of pulleys, the pieces generally must be pressed into the housing or onto the shaft, as the case may be, at considerable pressures. When the pieces are installed with hydraulic presses or sledges it necessarily follows that they come off just as hard if not much harder. Consequently time is unnecessarily lost in fumbling around with sledge hammers, wheel pullers and presses, and very often damage results.

With a minimum of time and effort, Mr. Cofrancesco can remove and replace either bearings or pulleys and without the damage which results from the application of high pressures. Allen set screws are used to hold the piece in position. The set screws are checked for tightness during each periodical routine inspection, which also includes checking bearings, air gaps, lubrication, control, etc. Good maintenance alone can insure full-time war production.

DRYING FILMS WITH INFRA-RED

INDUSTRIAL

Modern photography is a vital factor, not only to our fighting forces, but to war production of many types. One phase of photography is the drying operation. On rush orders, where time is of utmost importance, drying has always, more or less, been a bottleneck.

Pako Corporation of Minneapolis, met this problem by devising a new process whereby the drying is done by infra-red heat produced by long coiled heating elements. The process provides



INFRA-RED coiled heating elements in long strips partly encased in the troughs, are being used to dry picture negatives faster and more evenly.

even concentrated heat waves over the full length of the film and can be used in a dark room without danger of fogging the film since the elements burn below the temperature and brilliance of incandescence. Pako has learned that the films are dried faster, more evenly and with less distortion of the photographic image.

Today, this newest development is found in such diversified locations as battleships, training camps, air fields, large industrial plants, shipyards, etc., where photo-finishing machinery are important tools to speed war effort. It can also be used to considerable advantage in ordinary commercial photo work.



SYMBOL of America at war. Not a row of machine gun barrels but a row of prefabricated wall sections for war housing at San Diego, Calif., with conduits stuck up for connection above the ceiling level. The war brought in prefabricated housing in large-scale operations and with it prefabricated wiring. This picture is a symbol of what may come tomorrow.

and Motor Control shall be designed to:

1. PROVIDE THE GREATEST RELIABILITY
FOR TODAY'S HIGH SPEED WAR
PRODUCTION

that's Westinghouse

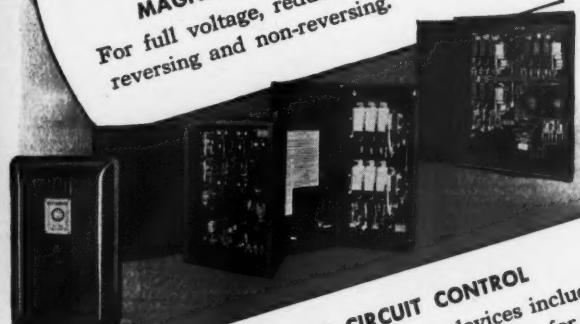
MANUAL MOTOR CONTROL

For full voltage, reduced voltage, or
step starting, speed regulating, reversing
and non-reversing.



MAGNETIC MOTOR STARTERS

For full voltage, reduced voltage, step,
reversing and non-reversing.



PILOT CIRCUIT CONTROL

All types of Pilot circuit devices including
push buttons and limit switches for both
standard and heavy-duty service.

Design features like the Westinghouse "De-ion" principle of arc extinction are certainly a common-sense "must". And today's production goals need the kind of protection that the Bi-metal overload relay can give. The Westinghouse line of a-c and d-c motor controls is complete for motor types that meet requirements of a wide variety of applications.

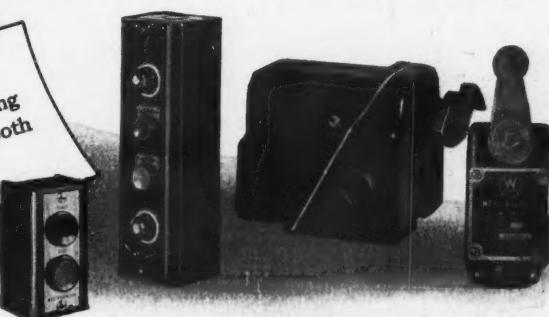
So when you need motor controls—write "Westinghouse" in the specifications. Then get your Westinghouse representative on the phone. He'll help you all the way from application to installation. Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., Dept. 7-N.

J-21270

Westinghouse
PLANTS IN 25 CITIES... OFFICES EVERYWHERE



MOTORS • AND • CONTROLS

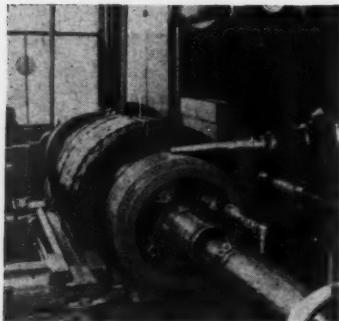


Motor Shops

PORTABLE UNDERCUTTER FOR HEAVY WORK

The Mielke Electric Works, Inc., Duluth, Minn., motor service shop was frequently encountered with the job of undercutting commutators of large armatures—too large to set up in a lathe. So they designed and built a unit that has a supporting frame that slides over the armature shaft and rests on the floor. The undercutter motor is mounted to a sliding base that is moved back and forth by a double thread feedscrew.

The supporting base consists of a cast arm which is bolted to a structural



MOUNTED ON LATHE, the same undercutting unit, minus the shaft collar and supporting arm, does the same job on smaller armatures.

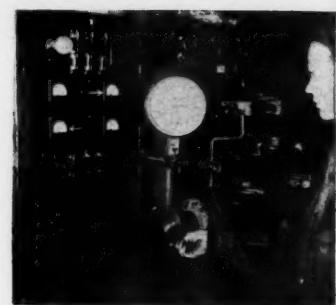
steel collar that slides over the armature shaft. The collar is fitted with two brass V-blocks, one on the bottom and one on the adjustable tightening screw on the top of the collar. The L-shaped cast arm supports the undercutter table in front of the commutator and contains two hand wheel adjustments. One is to raise and lower the arm itself; the other is to raise and lower the undercutter table to the proper height for the undercutting operation. The table is supported by two steel rods which ride in locking collars on the arm. Once the table is adjusted to the correct height, a twist on each of the locking handles keeps it from moving up or down.

The undercutter is moved from left to right and back again by the double-thread screw feed on the undercutter table. The operating lever can be attached to either end of the screw feed. The undercutter motor has a flexible cord connection that fits any convenience outlet in the shop. The same type of arrangement is used on lathes for smaller armatures. Here, the shaft collar and supporting arm are eliminated.

SMALL MOTOR PRONY BRAKE

A simple yet highly flexible prony brake is used for testing small motors at the Schneider Electrical Works, Omaha, Neb.

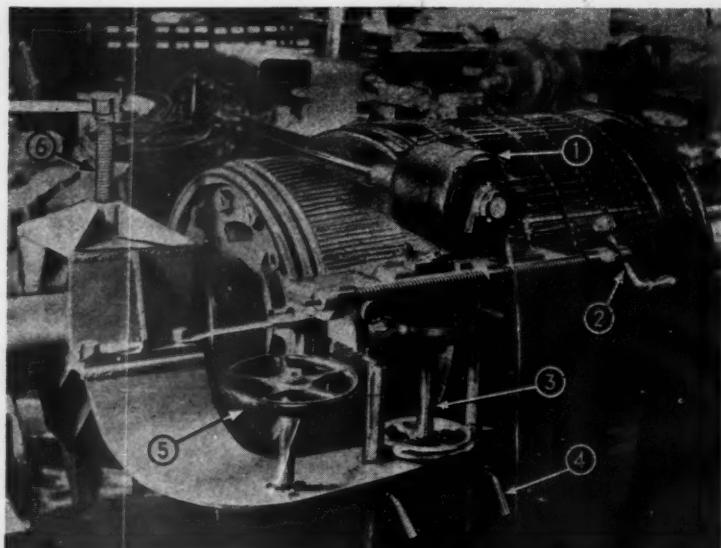
The actual brake mechanism consists primarily of two horizontal swinging arms mounted by means of split collars to a 1½-inch vertical pipe riser. The upper arm is a 22-inch piece of 1½-inch



CHECK TEST on small motors is made with this simple prony brake. Simplified clamp holds motors firmly to bench. Swinging arms provide flexibility to brake equipment.

pipe from which is suspended a dial type spring scale. A similar lower arm is equipped with an inverted V clamp to hold the motor to the workbench. Horizontal adjustment of this clamp is accomplished by a threaded crank which passes through a tapped hole in a piece of 1¼-inch solid steel stock inserted in the 1½-inch pipe arm. Vertical adjustment of this clamp is provided by a 14-inch slot cut into the arm. Both arms can be locked into any vertical or horizontal position necessary, depending on the size of the motor frame and length of the shaft.

Brake leverage is provided by a special 4-inch flanged pulley (3½ inch inside diameter) mounted to the motor shaft and a rope fastened to the scale and wound around the pulley. Although the scale has a 20-lb. dial, its maximum capacity is 40 pounds (pointer goes around dial twice). The pulley diam-



ADJUSTABLE FEATURES of portable undercutter unit for large armatures include (1) motor on sliding base; (2) feed screw; (3) vertical adjusting wheel for undercutter table; (4) locking devices for table; (5) vertical adjustment for supporting arm; (6) tightening screw for shaft collar.

BE SURE ... with CROCKER-WHEELER

CROCKER-WHEELER
JOSHUA HENDY IRON WORKS

Look anywhere in industry where motors and generators must resist damage, break down and wear... and there you will find Crocker-Wheeler. They have withstood the acid test of time.

Whatever your motor application problems may be, you may rely on the specialized knowledge of your Crocker-Wheeler field engineer. He is backed by a company which has specialized in the design and use of motors and generators for over 50 years.

Crocker-Wheeler Electric Manufacturing Co., Ampere, N. J.
Division of JOSHUA HENDY IRON WORKS

Other JOSHUA HENDY IRON WORKS factories at Sunnyvale, Pomona and Torrance, California and St. Louis, Mo.

What's wrong with this picture-



and right
with this? ▶

We can win this war only by the greatest economy of critical materials and manufacturing time. That is why the electrical control industry recommended point-to-point wiring as a wartime policy for it saves both copper and manhours. And that is why the War Production Board adopted this recommendation and has issued a directive requiring such construction . . . until Vic-

tory. Every user of electrical equipment is also urged to adopt point-to-point wiring throughout his plant, to conserve critical copper, to make sure our armed forces have enough, to shorten this war and cut the cost of Victory . . . CUTLER-HAMMER, Inc., 1306 St. Paul Avenue, Milwaukee, Wisconsin. Associate: Canadian Cutler-Hammer, Ltd., Toronto, Ontario.



CUTLER-HAMMER

MOTOR CONTROL



Motor Shops

[FROM PAGE 94]

eter is such that a 20-pound reading on the scale is equal to one horsepower at 1,750 r.p.m. A handy chart translates other scale readings into horsepower for the operator.

The meter board contains four meters. On the top left is a 0-300 V. voltmeter; top right, a double range wattmeter (0-1500 W. at 110 V. 0-3000 W. at 220 V.); lower left a 0-10 A. ammeter; lower right a 0-50 A. ammeter. The pushbutton between the two upper meters is for inserting the wattmeter in the circuit. The lower pushbutton, when operated, substitutes the 10 A. ammeter for the 50 A. meter which is normally in the circuit.

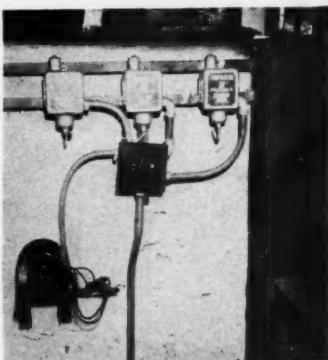
A fused, three-pole incoming line switch is at the top of the board. The two-pole double-throw selector switch is for obtaining 110-V or 220-V single phase current.

This arrangement, with all dials at the operator's eye level, provides a quick and accurate check test on motors both before and after they are repaired.

AUTOMATIC OVEN CONTROL

Three temperature controllers automatically regulate the baking temperature in the gas fired oven at the Schneider Electrical Works, Omaha, Nebraska, motor service shop. They control electrically operated valves on the gas jets.

One controller is set for 90 degrees C. and is used primarily for heat up purposes and to generate the fumes



THREE-WAY CONTROL of oven temperatures is accomplished by three Brown Instrument temperature controllers set at 90, 110 and 120 degrees C. Motor is for air circulating fan in oven.

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WAR TIME USES
ARE BUILDING PEACE-
TIME DEMAND for

Electric Audible Signaling



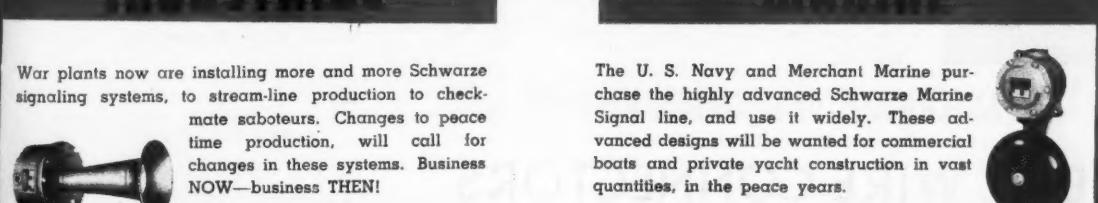
TIE UP NOW

WITH THIS TREMENDOUSLY
GROWING BUSINESS.



Profitable and logical sales are open to the electrical contractor,—both NOW and in the IMMEDIATE post-war period—on the essentially modern audible electrical signaling systems developed by Schwarze Electric Company, pioneer manufacturers in this field.

Lay a strong foundation now, through sales for war production, on which to build substantial future business, with steady profits. As your inventories are now low, this is the ideal time to take on this MODERN line!

INDUSTRIAL

MARINE

War plants now are installing more and more Schwarze signaling systems, to stream-line production to checkmate saboteurs. Changes to peace time production, will call for changes in these systems. Business NOW—business THEN!

The U. S. Navy and Merchant Marine purchase the highly advanced Schwarze Marine Signal line, and use it widely. These advanced designs will be wanted for commercial boats and private yacht construction in vast quantities, in the peace years.



ELECTRICAL SIGNALING A COMING INDUSTRY

Industrial and Marine applications are but two of the most obvious developments of audible electrical signaling as developed by SCHWARZE. WRITE TODAY for

the complete new Schwarze catalog,—a book which has received wide acclaim for its simplicity, ease of use, and efficient indexing. YOURS WITHOUT OBLIGATION

Distributors in Principal Cities

SCHWARZE ELECTRIC CO.

1906 CHURCH STREET

DETROIT, MICHIGAN

Solder Prohibited

COMPLY WITH GOVERNMENT REGULATIONS

Government Departments or Agencies which have issued orders, specifications, or recommendations to discontinue the use of solder type joints, are listed below:

- Critical Construction Materials Design Guide, Feb. 19, 1943, page 23 Section E.
- War Dept., Office of the Chief of Engineers, Section XXXIV, Oct. 20, 1942, page 34-02.
- W.P.B., War Housing Manual, Dec. 12, 1942, page 31, article 370.
- Army and Navy Munitions Board, Bulletin Jan. 1, 1943, To Supply Services, Etc., page 19, article 5.

IN WIRE JOINTS

Wherever Wire Connectors

Containing No Copper or Copper Alloys

Can Be Used

IDEAL
Wire-Nuts



MEET ALL GOVERNMENT REQUIREMENTS

We are passing along this information as we know every man in electrical work will want to comply with the requirements, by discontinuing the use of wire joints which require either solder, copper, or copper alloys—and help conserve critical metals.

AN ALTERNATE AND IMPROVEMENT

for Solder and Tape—

"IDEAL WIRE-CONNECTORS"

IDEAL "Wire-Nuts" (Solderless, Tapeless Wire Connectors) contain no copper or copper alloys—therefore meet all requirements mentioned above. Easy to apply; strip wire, screw on, that's all! Cut costs, speed war work,

If your Electrical Jobber, hasn't a supply kindly write or wire, mentioning jobber's name

→ PROMPT DELIVERY ←

IDEAL COMMUTATOR DRESSER CO.

1041 PARK AVENUE

Sales Offices In All Principal Cities

SYCAMORE, ILLINOIS

Motor Shops

[FROM PAGE 96]

which are removed under this temperature level. After being on for one to one and a half hours, this controller is shorted out by a toggle switch. The second controller, set for 110 degrees C. then takes over for the remainder of the baking period.

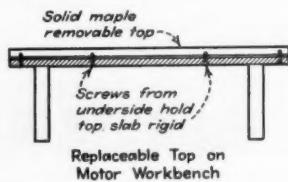
As a safety measure, a third or limit controller set for 120 degrees C., is in the circuit to cut off the gas in case controller No. 2 fails to function properly. The second switch in the accompanying photograph controls the circulating fan in the oven.

The D
CONT
For 2-
3-40
2-100

REMOVABLE TOP ON WORKBENCH

Frank Mielke, Mielke Electric Works, Inc., enterprising motor service shop of Duluth, Minn., believes in good housekeeping methods in his shop. Cleanliness, organization and appearance not only lift the morale of the workmen, but make a favorable impression on any customers who might visit the shop.

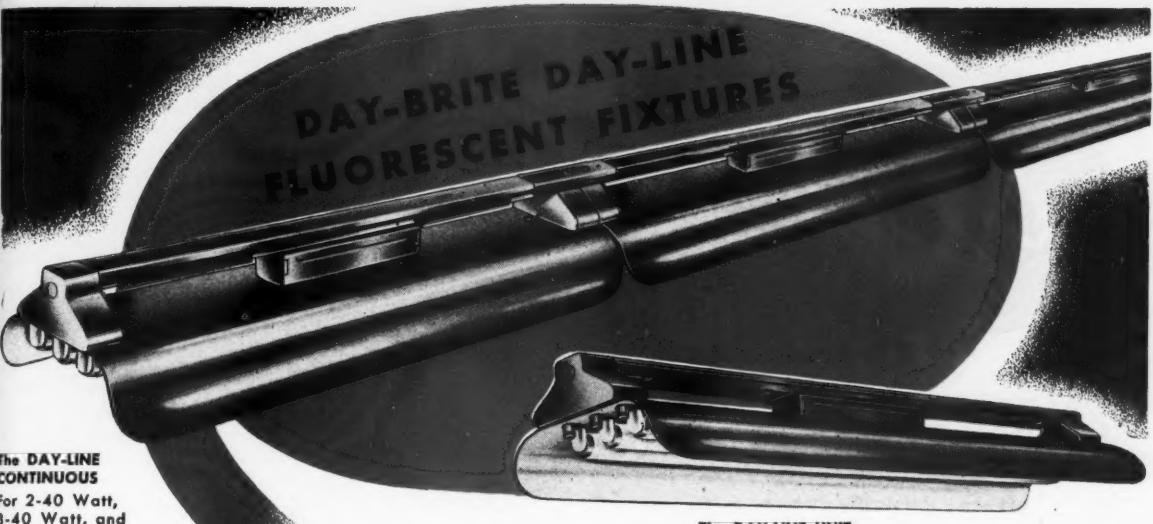
One of Frank's schemes to keep the workbenches gleaming and glistening is to peel off the tops and send them to the mill to be "laundered" whenever they get that weatherbeaten look—just



TWIN-LAYER tops on these workbenches permit the top slab to be easily removed and re-dressed when it becomes worn and unsightly.

as the wife does with the soiled tablecloth at home. Only, at the mill, they plane and sand the top down until it again is smooth and clean. Then a good coat of varnish finishes the job.

Frank can do this because he has designed all his workbenches with double tops, the finish top being a solid slab of maple, fastened to the bench by screws from the underside. The original cost of these special tops is not much, remarks Frank, and it only costs a few dollars to have one "laundered." Wood bench tops are preferred at the Mielke shop because they reduce the sliding and slipping encountered on steel tops. And with steel as it is today, this shop has nothing to worry about so far as workbenches are concerned.



The DAY-LINE
CONTINUOUS

For 2-40 Watt,
3-40 Watt, and
2-100 Watt Lamps

The DAY-LINE UNIT
For 2-40 Watt, 3-40 Watt, and 2-100 Watt Lamps

NEW WAR MODELS!

MEET W.P.B. STEEL LIMITATIONS

Still retaining all the superior illumination qualities of previous Day-Line Industrial Fixtures — these new War Models are designed to save critical war materials. They furnish light for the production front and release materials for the battle front.

An outstanding feature of these new War Models is the 1-piece end stamping which is welded to the "backbone" of the fixture. This insures unusually substantial construction . . . In assembling the units into continuous runs a high degree of rigidity is attained by employing a strap coupler which is securely bolted into position . . . Flexible surface or suspension mounting . . . Starters accessible without disturbing lamps . . . Non-metallic reflectors are quickly removable for free access to wireways . . . Ballast maintained under top channel for cool operation . . . Get further details. Call your Day-Brite Engineering Representative.

DAY-BRITE LIGHTING, INCORPORATED
5434 BULWER AVE. • SAINT LOUIS, MISSOURI



THE SIGN OF QUALITY
LOOK FOR THE LABEL



The COMPLETE LINE OF FLUORESCENT LIGHTING FIXTURES Nationally distributed through all leading electrical supply houses

Questions ON THE Code

Answered by
F. N. M. SQUIRES
 Chief Inspector New York Board of Fire Underwriters

Feed Crossing Highway

Q. "I have a customer who wishes to run 110-220 volts across the highway to a store building and the material which I have available is No. 4 bare. The present line which the customer has is inadequate to carry the load. I shall put these lines up securely and give them 18 feet clearance above the highway. It will be fused at both ends and approximately 40 amperes on the energizing end. Is this permissible?"—A.S.

A. Bare conductor wiring for use as outlined above is not approved by the National Electrical Code. Rule 7302 requires that open wires on insulators shall have rubber or weather proof coverings. If rubber covered or weather proof wires are used, then a clearance of 18 feet above the highway is required.

Practically all cities and some towns and villages as well as some counties and states have local ordinances regarding the running of wires over public highways. Also, many times franchises are involved. These should, of course, be looked into before stringing the wires.

Splices in Sealing Fittings

Statement: In last month's *Questions on the Code* there was a brief explanation of the reasons why splices are not permissible in sealing fittings. A correspondent, C. H. B., adds additional data and comment on this important subject as follows:

"Fittings intended only for sealing purposes frequently are large enough to house splices but when these fittings were filled with compound, it would be

difficult, if not impossible, to remove the covers, but even though the covers could be removed the splices would be buried within the compound and therefore not accessible.

"Another reason is that the sealing compounds used are mixed with water and very few splices are so well wrapped as to be watertight.

"The phraseology of the last part of the sentence in Rule 5014b is intended to apply to certain kinds of devices such as interlocked plug and switch, in which case a sealing well is provided directly above the terminals of the receptacle. Pigtails lead protrude through the sealing compound and they are either spliced or connected to switch terminals or circuit wires. Under these conditions the entire cavity cannot be filled with sealing material.

"Regarding sealing at motors, it is my understanding that Underwriters' Laboratories require that explosion-proof

motors be equipped with a seal through which the leads protrude. Furthermore, that it is not expected that arcing or sparking will take place in the motor terminal box any more than in any other type of junction box and therefore an additional seal external to the motor is unnecessary."

New Type Insulation

Q. "I have a house in the country where I can wire it with knob and tube work. Can I use some of this new paper insulated wire for the job?"—A.M.C.

A. No, not entirely, although some may be used on the job. By "this new paper insulated wire", probably is meant the "emergency insulation (type EI) wire". This EI wire may be used for the ungrounded (live) conductor, only for open wiring (exposed) and for non-metallic sheathed cable when run exposed, and only for the duration. This requirement for its being exposed, is to prevent its easy removal after the war.

Where some of this may be used by our inquirer on his job is on the neutral of the knob and tube wiring. It can not be used for the ungrounded or "live" conductor.

There is also another paper insulated wire which may be used only for the grounded neutral and this is the type EG wire. This wire is similar to the type EI wire but the paper insulation is processed a little differently.

Pennies Cause Fires?

Q. "Are there now many fires caused by bridging out fuses by putting pennies in back of them or by using tinfoil or wire around them, or is the talk about these fires all 'hokum'?"—L.E.E.

A. The function of any protective device is to prevent fire. Tampering naturally reduces or eliminates that protection, and this may result in fires starting from various other causes, such as over-heated wires, over-heated armor, etc., etc.

Here is a recent news item from the Muncie (Ind.) Morning Star, Thursday, April 22, 1943, which bears us out.

New Castle, Ind., April 21. A penny placed behind a 30 ampere fuse in the basement of the Jennings Building here may have caused the \$250,000 fire which destroyed the entire three story structure here Tuesday.

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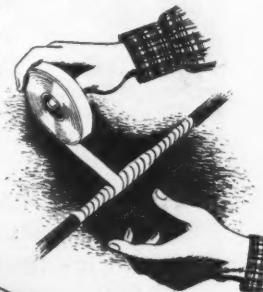
starts with a roll of cloth . . .

THE first essential for judging the quality of friction tape is the strength and durability of the basic fabric used in its manufacture.

A substantial fabric forms the basis for PANTHER and DRAGON Tapes. This fabric provides a finished product that liberally meets the requirements of current specifications.

Compare all of today's features of PANTHER and DRAGON Friction and Rubber Tapes with Federal Emer-

gency and A.S.T.M. requirements and you will find the reasons why so many electrical contractors are specifying and using these high grade tapes.



Sold through Recognized Independent Wholesalers . . .



Rubber tapes are available in both PANTHER and DRAGON Brands.

RUBBER TAPE

1. Guaranteed Footage
2. Substantial Fabric
3. High Tensile Strength
4. High Dielectric Strength
5. High Adhesive Strength
6. Uniform Thickness
7. Uniform Width
8. Excellent Tackiness
9. Strong, Durable Core
10. Colorful, Attractive Boxes

FRICTION TAPE

1. Guaranteed Footage
2. High Grade Compound
3. High Tensile Strength
4. High Elongation
5. High Dielectric Strength
6. Uniformity of Thickness and Width
7. Excellent Fusion
8. High Insulation Resistance
9. Excellent Tackiness
10. Colorful, Attractive Boxes

PANTHER & DRAGON FRICTION AND RUBBER TAPES

HAZARD INSULATED
WIRE WORKS

DIVISION OF
THE OKONITE CO.

WILKES-BARRE, PENNSYLVANIA • OFFICES IN PRINCIPAL CITIES

3311

NEW LOW-PRICED

Permaflector 200 WATT FLUORESCENT



PERMAFLECTOR
ENCLOSED
FLUORESCENT
ST-200
120 VOLTS
1000 CANDLES

Powerful beam of light from a standard 200-watt lamp! Offers higher priced mechanical and performance features at low cost. Built to "take it", ST-200 is ideal for service on power shovels, bulldozers, trucks and cranes. Completely adjustable.

SHOCK and WEATHER-PROOFED

Silver-mirrored glass PERMAFLECTOR; mounted on corrosion-resistant sheet steel; convex, stippled, heat-resisting, 8½" lens; porcelain socket; weather-proof cord grip fitting; 12½" high overall; weighs only 6½ lbs.

Adjustable!

Can swing vertically,
180° horizontally, by
adjusting wing nuts on
bracket and base.

Data!

Please rush complete data on small-wattage PERMAFLECTOR
Floodlight ST-200 - EC 6-43

NAME _____

ADDRESS _____

CITY _____

STATE _____

Permaflectors

*Questions
in the Code*

[FROM PAGE 100]

Fire Chief George Van Zandt said tonight that in all probability the penny, found this morning by an electrician, who had gone into the water filled basement, had been responsible for New Castle's worst fire. He stated that firemen, on arriving at the fire, noticed a redhot electric conduit in the basement. The BX type conduit fed the building's stoker and ran upstairs to what Van Zand termed an obsolete thermostat. The short circuit developed somewhere along the wiring and because of the bridging across by the penny which had been placed behind the fuse that had previously blown out. This caused intense heat which fired the joist to which the box was attached."

Electrical fires are almost always the result of abuse—whether it be by bridging the protective device or by keeping a worn-out cord in use. The obvious answer, and only real protection for the public, is periodic reinspection backed up by a publicity campaign to educate people to the dangers of being home electricians.

OFFICIAL INTERPRETATIONS

by the

Electrical Committee of the N.F.P.A.

Interpretation No. 240

STATEMENT . . . A multi-story and basement building is being used as a commercial garage (as defined in Article 100), with inside ramps and small elevator which pierces all floors including the basement. Automobiles are stored and repaired on all floors and basement. There is no dispensing pump for filling car tanks.

Spark producing devices such as switches, receptacles, motors, and the like are located more than four feet from all floors.

QUESTION 1 . . . Is there any portion of the electrical installation which must be installed to comply with Class I locations as defined in Article 500?

QUESTION 2 . . . A building as described in the statement except that there is a dispensing unit for filling car tanks and spark producing devices such as switches, receptacles, motors, and the like are located less than four feet from the floor. Must such devices be installed as defined in Article 500?

QUESTION 3 . . . In a building as described in the "Statement" and in question 2 where the wiring complies with any of the methods described in section 5102, is it necessary to comply with section 5014-b?

QUESTION 4 . . . In a commercial garage as defined in Article 100, will section 5102 allow surface metal raceway, armored

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cable, electrical metallic tubing, wireways, busways and/or cellular metal floor raceways installed less than four feet from the floor and connected to devices which comply with Class I in Article 500?

QUESTION 5 . . . In a commercial garage as defined in Article 100, and where the installation is made as described in question 4, will it be required that there be compliance with section 5014-b if the wiring method used is other than conduit?

ANSWERS . . . a. Premises used as a garage (see definitions, Article 100) "involve special occupancies, special equipment or other special conditions" as discussed for Code arrangement in the Introduction of the Code, and the intent is to apply Article 510 as supplementary to, or amendatory of, the general rules of Chapters 1-4, incl., Article 500 does not apply except as in paragraph c of section 5103. This is as indicated by the cross-reference to Article 510 in section 5001.

b. When the provisions of paragraph c of section 5103 apply, it is appropriate to specify rigid conduit as the wiring method (up to the four-foot level) as called for in section 5014 and to seal-off all conduit runs as called for in paragraph b of this section. Otherwise the safeguarding contemplated by paragraph c of section 5103 will not be accomplished.

c. Attention is called to rule 12 (e) and rule 27 (b) of the Standard for Garages, National Board of Fire Underwriters pamphlet No. 88.

Interpretation No. 241

STATEMENT . . . A two-wire feeder circuit, both wires insulated from ground, supplies 500-volt direct-current to motors in commercial and industrial premises. The circuit is fed from a station bus from which is also fed a 600-volt trolley street car circuit with a grounded negative return.

QUESTION . . . Is this feeder circuit in violation of section 1110?

ANSWER . . . Yes.

Interpretation No. 242

QUESTION . . . When a run of service conductors consists of two Type R insulated copper conductors and one bare copper conductor (all three being No. 0), shall the size of conduit be determined according to Table 4 or Table 11 of Chapter 10?

ANSWER . . . Table 11 is appropriate.

Chicago Inspector NECA Field Man

The National Electrical Contractors Association has recently appointed E. L. Santschi, electrical inspector for the city of Chicago, a member of their Field Service group. Mr. Santschi's assignment includes the States of Michigan, Indiana, Illinois, Wisconsin, Minnesota, Iowa, Missouri, North Dakota, South Dakota and Nebraska.



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★ By Providing the Lighting Units that Make SEEING Easier, You Help to Safeguard Employees' Health, Efficiency and Safety!

It is the duty of everyone in war production and essential industrial and military tasks to keep in best possible condition; to be physically strong and mentally alert.

HOW "RIGHT KIND OF LIGHTING"

HELPS US TO KEEP IN PEAK CONDITION

The personal experience of men and women employed in war tasks shows that the right kind of lighting is an important factor in keeping them on top of their jobs. By making it easier to see, the right kind of lighting minimizes eyestrain and thus reduces fatigue.

War production experience has shown that protection against eyestrain fatigue:

- makes the job less tiring
- increases alertness against accidents
- conserves reserve energy needed for sustained effort and provides additional protection against the ill effects of fatigue.

Today all of these things are vitally important. The ever increasing demand upon all of

us for "most production with the least amount of defects and spoilage" is a goal that we cannot fully achieve unless we are physically fit.

Laboratory experiments and actual plant experience show that the basis of the right kind of lighting must be enough light, which in most war production plants should be somewhere between 30 and 50 foot candles—even more for certain types of precision work.

WHAT IS THE "RIGHT KIND OF LIGHTING"?

However, there is much more to the right kind of lighting than sufficient light for the specific seeing task. Ease of seeing depends also upon the quality of the lighting, its proper direction, diffusion, uniform distribution, and brightness.

It depends upon the elimination of glare from exposed and improperly shielded lamps in the lighting units; the elimination of reflections from shiny surfaces; the elimination of deep shadows and spotty lighting; and choice of proper lighting units for the seeing task and physical requirements of the location and operation.

To provide the lighting units and engineering counsel which will insure the right kind of lighting to war production plants, the army, navy and merchant marine, is Benjamin's major war task...a task in which every man and woman in the Benjamin organization in the plant and in the field, is proud to have a part.

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HOT SPOTS

EVERY production line has hot spots. Often there are many places where heat under closely controlled temperature limits is required. One application is no more important than another. It is as essential, for instance, to keep isolated valve and meter houses well above freezing as it is to provide critically controlled temperature ranges for salt baths and curing ovens. Electric heat with automatic control is the most accurate means of maintaining these operating specifications.

But in addition to its accuracy, electric heat is efficient. It can be localized to the exact spot where it is needed. There are no expensive pipe lines bundled in insulation to reduce losses. There are no splashes of flame that spread heat into areas where it is neither needed nor wanted.

One very important feature in the use of these units is their flexibility. Many knotty production problems can be untangled by bringing the heat to the production line instead of routing material back through ovens.

The accompanying article illustrates by example a few applications which portray the many ways that electric heat can be used in pilot plants and laboratory procedures as well as in production lines.

Previous articles covered—
Electrifying Operations to Reduce Unit Costs
Safety Protection for Electrical Operations
Increasing Flexibility of Electrical Service
Electrical Aids to Automatic Control
Electrical Ways to Reduce Waste
How to Save Power
Protection Against Sabotage
Improving Working Conditions
Electrifying for Continuous Operation
Electrified Plant Housekeeping
Electrical Problems Under 168 Hour Schedules
Electrical Aids to Plant Conversion
Electrical Aids to Quality Control
Electrical Aids for Green Help
Codes in Wartime
Grounding for Safety
Air Raid Restoration
Operating Replacements
Preparing for Blackouts
Wiring for Quick Changes
Power Factor Improvement
Electric Heat Speeds Production (this issue)

ELECTRIC HEAT SPEEDS PRODUCTION

THIS article will not go into a technical discussion of the entire subject of electric heat but will confine itself to, and show by example, the application of standard electric heating units and devices to problems of a war emergency nature. In this field, modern standard heating units offer surprisingly flexible solutions to a wide variety of jobs. They are means to do things in a simple and effective way that at the same time often is the efficient permanent solution of the emergency need. This is a good time to brush up on the possible uses of these handy and helpful units.

Low temperature electric heating units, those operating from room temperature up to 1,000° F., essentially are self-contained sources of heat, consisting of nickel-chromium resistance wire embedded in an electrical insulating heat-conducting refractory and enclosed in a metal sheath. Units are equipped with terminals to connect to power supply and often are equipped with a means of mounting, such as mounting holes or tabs. It is possible to clamp the units on metal surfaces, insert them in drilled holes, attach them to metal supports without the use of secondary insulating bushings (except for voltages over 440) or to submerge them in tanks of liquid or melted substances. The data sheet accompanying this article illustrates a range of the standard types, with a table containing a brief description of each and suggesting logical fields of application.

Eight common problems arising in war conditions which you can handle with standard electrical heating units.

1. Heating of compounds, soft metal melting pots, dies, platens, to obtain more uniform temperatures to meet more rigid production specifications.
2. Booster heating to obtain higher temperatures and greater production output with existing equipment.
3. Heating of ovens, baths, and other equipment requiring uniform heating, and controls for testing parts to meet



AN AID to meet finicky specifications. Portable immersion heating units operating at low watt density keep dip compound from chilling to point that causes imperfections in the finish after baking. The units are lowered into the tank at night. During the day the room temperature alone is sufficient to keep the mixture above the critical temperature point and the units may be switched off.

specifications set up by the Armed Forces.

4. Pre-heating of plastics before punching or forming.

5. Pre-heating of heavy metal sections and maintaining minimum temperatures prior to and during welding.

6. Heating of pipe-lines and conveyors to prevent materials from solidifying while being transferred from one point to another.

7. Heating of factory offices, watchmen's shanties, small buildings, and unattended buildings, such as valve houses, sub-stations, etc.

8. Temporary process heating while awaiting delivery of more elaborate equipment.

Electric heat has many advantages; it is uniform, usually low in cost; installations can be made quickly; control devices are available for a wide range of accuracy; it is instantly ready day or night; it eliminates guess work; it is safe; and it can be applied exactly at the point needed eliminating unnecessary heat losses attendant to other heat methods.

While units are standard, there are many useful kinks in application. It often pays therefore to call in a man who has had experience in meeting a variety of conditions. Reputable heating unit manufacturers have competent service engineers to help electrical contractors and plant electrical men. Many power companies have electrical heating specialists who can render similar assistance. Check with such men if there is any question of doubt as to the best solution to a specific problem.

For a better understanding of its possibilities a few examples are cited as to how standard electric heating units have been used on typical normal emergency production jobs to improve



DOMESTIC washing machine is converted into small parts cleaner by supplying heat with 5000-watt immersion units. This conversion is a good example of clever application of electric heat to solve problems of war emergency type of work.

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quality of output, increase speed of operations, and to gain rigid adherence to stiffer specifications.

Uniform Coatings

An application of standard electric strip heaters for heating a pick-up roll which revolves in a tank of heated compound was recently made by a manufacturer of specially coated metal sheets. It was necessary to heat the pick-up roll to a uniform temperature in order to assure a uniform coating. It was also necessary to heat the compound tank without the use of an open flame. Immersion heaters with automatic controlling thermostats were installed in the compound tank. Electric strip heaters were installed inside the rolls in such a manner that the heaters did not revolve with the rolls. A special metal shoe with a thermostat bulb was allowed to ride on the rolls to maintain the temperature of the rolls uniformly, so that a uniform coating was obtained on the sheets. The units maintain this compound at a close operating temperature, assuring the uniform results and maximum speed of operation which are essential under present day conditions.

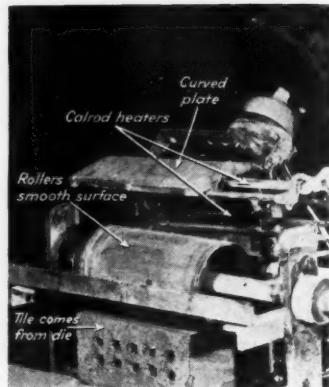
In this particular plant, no highly technical help was available, and it was imperative that equipment be installed which would require a minimum of attention. To date the only attention required by this equipment is the opening or closing of a disconnect switch to disconnect the heaters at the end of the working day, or to turn them on in sufficient time to have them up to temperature when work is ready to start.

Boosting Temperature

A large manufacturer of wire rope has been using for years a steam jacketed melting tank for heavy compounds used to coat this rope. The specifications came through to use a coating material which would require a higher temperature than it was possible to obtain with steam jacketed tanks. Immersion heaters were installed in the tank to provide additional heat under automatic temperature control. The installation was so successful that a second and a third unit were later added to boost production capacity.

Curing Thread

An experimental order was received by a manufacturer for some specially coated thread which had to be cured in an oven at a temperature of around 300° F. This finished material was vitally needed and time was short. The



SEMI CIRCULAR metal plate equipped with 4 GE 750-watt calrod units keeps roll warm and dry, and thus permits higher processing speed and more uniform quality of product.

company was able to build an oven heated with electric strip heaters, automatically controlled. A blower was installed for circulating the air in order to obtain uniform temperature distribution. The delivery schedule was met although the oven was built only as a temporary expedient. It is now in constant use and the manufacturer has been amazed at the amount of production which this oven, built only for experimental purposes, has been able to turn out.

Dependability

About 12 years ago one of our manufacturers of aircraft parts constructed an electrically heated salt bath and standard stock strip heaters were used to heat the bath to a temperature of 950° F. This equipment was in continuous day and night operation for a period of six years. It then was dismantled and inspected during a vacation period, and the heaters were found to be in perfect condition. The equipment is in operation still; today turning out parts vitally needed in the war effort. This is a good example of the dependability of electric heat as applied to a common war production requirement.

Plastics Preheat

In the field of plastics electric heat is playing a prominent part. Electrically heated and thermostatically controlled hot plates are used to preheat plastics prior to punching, so that the plastic material will punch clean and not stick to the die. This pre-heating also increases production and saves wear and tear on the die. One manufacturer constructed a series of portable hot plates which could be moved easily from one

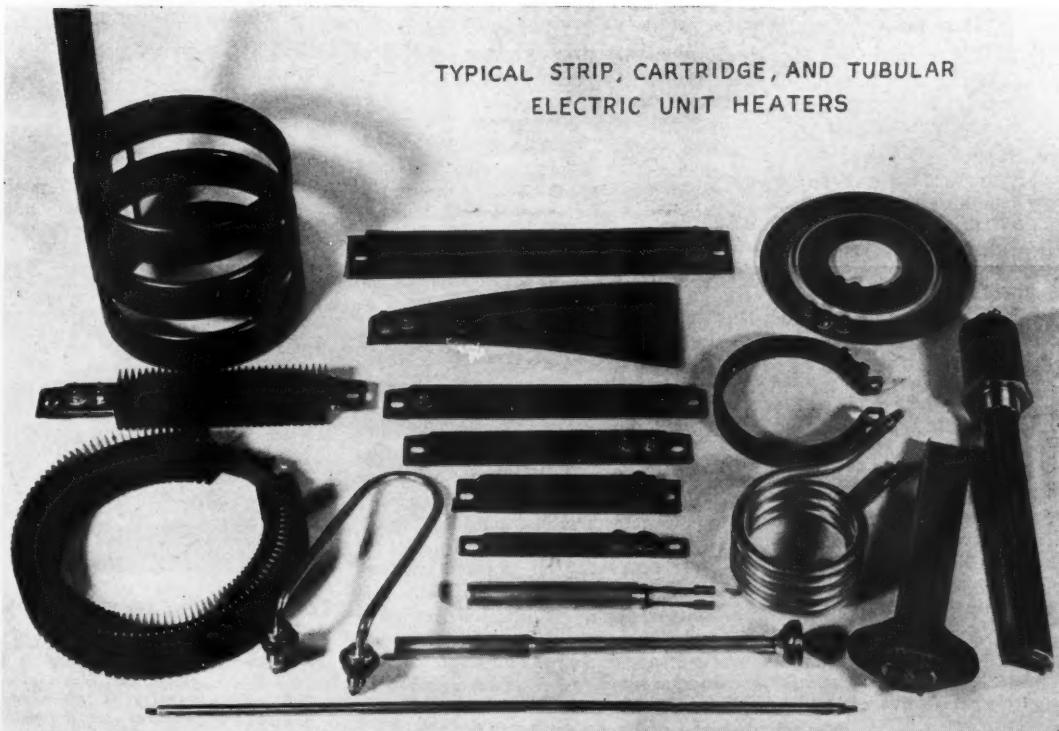
GUIDE SHEET

Standard Types of Electric Heating Units

TYPE	SHAPE	APPROXIMATE SIZE RANGE	TYPICAL APPLICATIONS
Strip heaters.....	Rectangular in cross section. Can be preformed to a curved section for contact heating of cylindrical surfaces	1/4-in. to 7/16-in. thick 3/4-in. to 2 1/2-in. wide 4-ins. to 15-ft. long Segment form flat or preformed	Liquid heating, salt baths Soft metal melting Die or platen heating Resistance units Oven heating Air heating Valve heating Contact heaters Radiant heaters
Cartridge units.....	Cylindrical in shape	3/8-in. to 4-ins. diameter 1-in. to 5-ft. long	Liquid heating, salt baths Soft metal melting Die or platen heating Soldering irons, special heated tools
Ring units	Rectangular in cross section	2 1/4-ins. to 11-ins. outside diameter, 1/4-in. to 7/16-in. thick	Liquid heating, salt baths Soft metal melting Die or platen heating Contact heaters Radiant heaters
Tubular units.....	Circular or triangular in cross section. Can be preformed or bent to various shapes	5/16-in. to 5/8-in. diameter 12-ins. to 10-ft. long	Liquid heating, salt baths Soft metal melting Die or platen heating
Immersion heaters.....	May use any of above heating elements fastened to screw plugs, flanges, or arranged for portable use	The size and shapes vary considerably	Liquid heating, salt baths Soft metal melting Die or platen heating

Compiled by Edwin L. Wiegand Company

TYPICAL STRIP, CARTRIDGE, AND TUBULAR
ELECTRIC UNIT HEATERS





DON'T OVERLOOK the domestic electric heat units for a variety of war work. Here an iron is quick-pressing a form for a self-sealing tank. Many similar applications may be found.

press to another for this purpose.

In molding or curing plastic material, electric heaters can be built into molds or dies to produce uniform heating of the piece.

Automatic molding presses, injection molding presses, and the conventional platen presses are now being extensively heated by means of electric heating units with thermostatic controls. Many of the temperatures required for the proper molding or curing of plastic materials are higher than can be obtained with steam. The use of electric heat eliminates expensive piping and reduces maintenance. There are any number of plants today that have dozens of electrically heated molding presses and dies.

Fluid Lines

Electric heat is playing an important part in keeping viscous materials and soft metals flowing through pipe-lines and valves. Standard electric heating units are clamped to valves or pipe-lines to maintain a constant temperature over the entire length of delivery so that the material will flow to the point of distribution without clogging up the lines.

Pilot Plant Operations

In the oil refinery laboratories, chemical manufacturing plants and others, electrically heated equipment is used to produce products on a laboratory or limited scale.

The machinery or equipment may be a small scale model of large production equipment using other forms of heat.

However, electric heating elements can be applied to the small scale equipment more easily, and can be applied and controlled to produce uniform results, duplicating plant conditions.

Again experimental equipment or pilot plant equipment is often changed or redesigned frequently. The heaters and controls are salvaged and used again.

One manufacturer of a special chemical used pyrex glass flasks immersed in an electrically heated thermostatically controlled oil bath to produce a product on a limited scale for our war effort. The production machinery, eventually obtained, was extremely special and used scarce alloy materials which required months to deliver. In the meantime, the temporary equipment briefly described above enabled this manufacturer to supply his product in sufficient quantities to satisfy his most urgent requirements.

Isolated Areas

The new building and the expansion of old plants for war purposes has created a multitude of spots which need space heat, but which cannot be connected efficiently or quickly to the main heating system. These are guardhouses, watchman's shanties, factory offices, unattended valve houses, special equipment areas, small storage areas, etc. Portable electric heaters can be installed temporarily and in many cases can be used permanently in these odd spots. Many temporary buildings use electric heaters because of the low installation cost and the elimination of the necessity for running expensive steam and return lines long distances from the main heating or boiler plant.

Electric air heaters are available with or without a circulating fan. The low initial installation cost and the ease with which the temperature can be controlled are important factors in the use of electric air heaters. In many cases strip heaters are used.

Many unattended rooms and spaces such as valve houses are heated electrically. Small buildings containing delicate instruments use electric air heaters thermostatically controlled so that the instruments are always at a uniform temperature, as well as to eliminate condensation of moisture on these instruments.

Means of Control

The ease with which standard electric heating devices can be controlled is one of their good assets. The means of control vary from the use of on and off switches to the use of expensive automatic control instruments.

The most commonly used control devices consist of on and off switches, multi-circuit switches, time cycle controls, rheostats and transformers for manual control, and a wide variety of types and sizes of automatic control instruments. These all range in price from a few dollars to hundreds of dollars.

Regardless of the problem, there is a control device, manual or automatic, available to satisfy the needs of any particular problem.

The extraordinarily flexibility in application of conventional electrical heating elements opens a way to many ingenious uses in war manufacturing. The range of electric heat applications has been, of course, further extended by the development of excellent radiant heat sources.

Batteries of radiant heat lamps are used in industry for drying, baking, softening and a host of specialized processes. These applications are beyond the scope of this article and in themselves a subject for equally detailed treatment.

However, the focused radiant energy from banks of heat lamps can often be effectively combined with other types of electric heating methods to advantage in process and space heating problems.

In remote outbuildings or other areas where electric heating is used for the comfort of personnel, radiant heat lamps can often be added to improve the working conditions. An instance of such use is the case of a weighman in a coal yard. The door and window to his office were frequently opened and control of air temperature was virtually impossible in cold weather. A battery of six heat lamps aimed at his desk chair solved the problem.

Similar combined use of electric air heaters and radiant sources may be applied to many difficult spots where the health and comfort of personnel is an important factor.



SEALED electric hot plate is a useful and safe tool for emergency work. This one is used for heating an inflammable alcohol solution. 5 kw. is used on 230 volt power supply. Cast iron top, with lip to catch drippings is 18 $\frac{1}{2}$ in. in diameter. Can be moved quickly and easily to any point in the shop.

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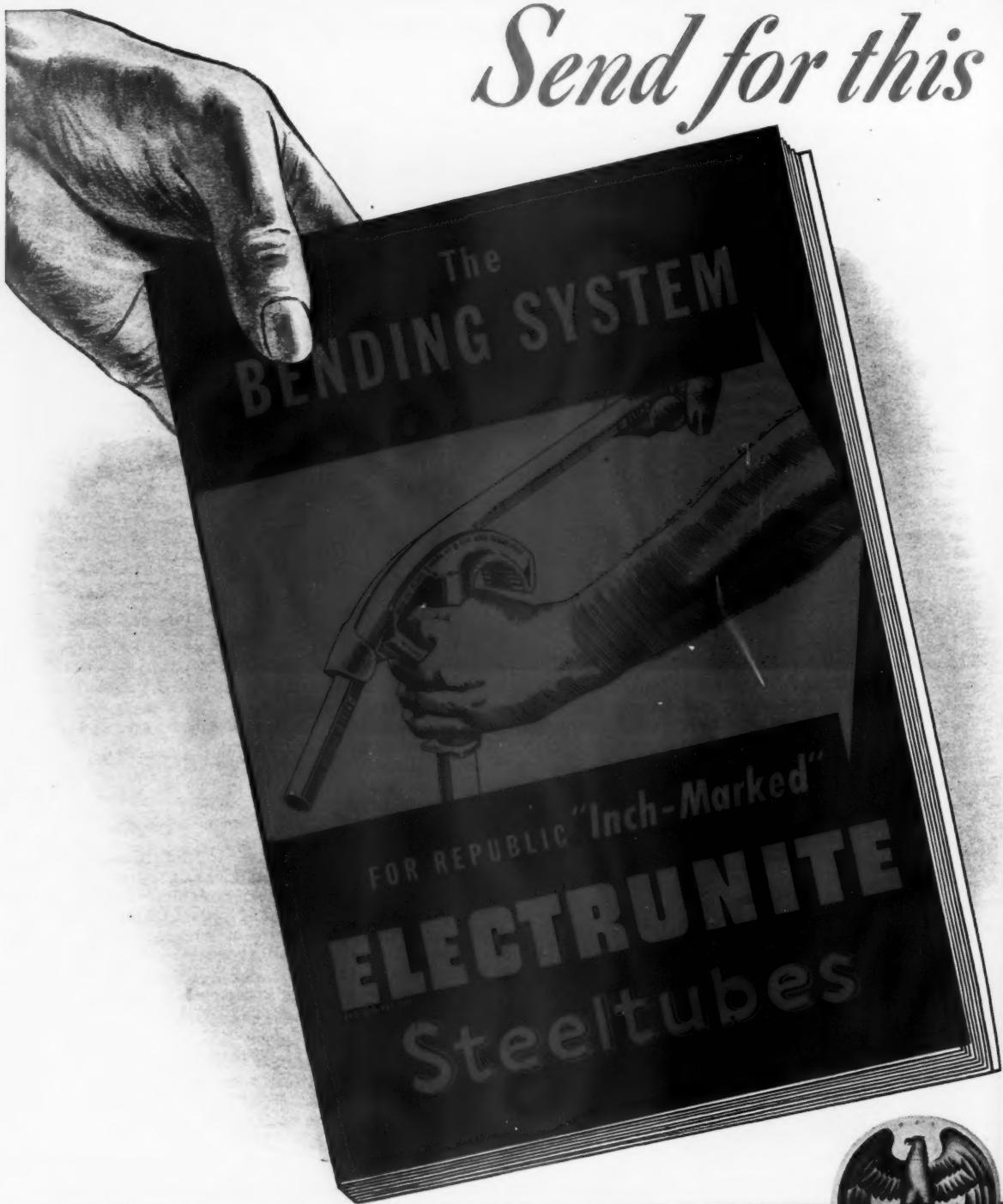
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Reader's QUIZ

QUESTIONS from readers on problems of industrial equipment, installation, maintenance and repair. Answered by electrical maintenance engineers and industrial electrical contractors out of their experience. For every question and every answer published, we pay \$5.00.

POWER FACTOR METER DIAL

QUESTION 95. The power meter dial is made with an upper set of leading and lagging figures and also a lower set like a complete set of false teeth. If the pointer should swing down into the lower set of figures, would it make any difference?—R.G.S.

A. TO QUESTION 95. The instrument should be connected so that the pointer will indicate on the lower scale when power is being returned to the line and when pointer is on upper scale it will indicate when power is being delivered to the line. All instruments having two scales are for this purpose.—B.M.

A. TO QUESTION 95. The power factor meter in question is designed to indicate direction of power flow as well as power factor; hence has two scales displaced exactly 180° from one another. With instrument connected properly, the pointer will indicate in the upper scale for one direction of circuit power flow, and on the lower scale if power flow reverses. Correct power factor will be indicated in either case. The same effect can be obtained by reversing the connections to the current coil of the instrument.

Circuits in which power flow reverses are uncommon, it is likely that the instrument in question is incorrectly connected. This may be checked as follows: with instrument connected to potential and current supply note position of pointer. Then place momentary short circuit across the instrument current

studs. The instrument is connected properly if the pointer moves in the "lag" direction with current studs shorted.—N.H.K.

A. TO QUESTION 95. The p.f. meter you refer to is a rotating field type. It has a bottom scale, an exact duplicate of the upper scale, and the scale in use depends on how you connect the meter. If the pointer indicates, on the bottom scale, change your leads (for instance, with a 3 phase meter interchange any 2 leads) and the pointer will indicate on the upper scale. The upper left hand scale reads "lag" while the lower right hand scale reads "lag." Similarly, the upper right and the lower left hand scales indicate leading power factor. Either scale is correct, though the bottom one may be superfluous.—R.W.D.

A. TO QUESTION 95. The meter pointer should not ordinarily swing from one scale to the other but when connected according to the wiring diagram supplied by the instrument maker, power factor may be easily read from either of the two scales as chosen.

Most present day installations do not utilize the 360 degree scale on the power factor meter. This type of instrument operates on the moving-iron vane principle.

In a synchroscope two separate sources of a.c. voltage are connected to the instrument to indicate the degree of phase displacement as an aid in synchronizing two circuits. The power factor instrument measures the phase displacement between the voltage and current in the same line and the scale is usually graduated with the cosine of the degrees and so reads power factor and type above may be connected to read in two opposite positions.—E.F.W.

DISCHARGE RESISTANCE

QUESTION 96. How would you figure the average size of a field discharge resistance to be used on a magnetic pulley using two amperes at 120 volts direct current? —W.L.C.

A. TO QUESTION 96. The discharge resistance should be equal to the resistance of the magnetic pulley winding. Therefore 2 amperes and 120 volts being the rated current and voltage of the pulley, the resistance would be $R = E \div I$ or $120 \div 2 = 60$ ohms, the resistance of the discharge resistor.—B.C.M.

A. TO QUESTION 96. In our plant we use resistors with approximately the same rating in watts as the magnetic pulley. It is composed of a 120 volt strip heater of the proper size mounted in the switch box.—J.S.

A. TO QUESTION 96. The value of resistance usually used in field-discharge resistors, placed in parallel with the field, is equal to the field resistance. In your case, if the field current is 2 amperes at 120 volts, the resistance of the field would be $R = \frac{120}{2} = 60$ ohms. Use a resistance of 60 to 90 ohms.—V.M.

A. TO QUESTION 96. In figuring the size of a discharge resistance I would assume that the resistance should be at least that of the field or the magnetic pulley coil and might be as much as twice the resistance. With a coil carrying 2 amperes at 120 volts direct current the discharge resistance should amount to 60 to 100 ohms. It should be of large enough wire to carry the current safely.—J.E.W.

METERS USED BY POWER COMPANIES

QUESTION 97. Why do power companies use a meter that is apparently the same as a three phase meter on a three wire, single phase service that is fed from a three phase, four wire wye distribution system?—E.M.O.

A. TO QUESTION 97. A single-phase watthour meter has one or two current coils and one or two potential coils, all acting upon the same

disc. A polyphase meter has two or more elements, each consisting of a current coil and a potential coil, each element moving its own disc.

Actually, 3-wire single-phase power is not delivered from two phase wires and the neutral of a three-phase four-wire secondary. The line-to-line voltage is 1.73 times the line-to-neutral voltages. The two line-to-neutral voltages differ 120° in phase when measured with respect to one phase rotation and 240° with respect to the other.

Even at unity power factor, there will be a phase difference between the line currents and the line-to-line voltage in such a system. A two-element meter (or a combination of two single-element meters) is therefore necessary in order to integrate the true value of energy delivered.—L.B.

A. TO QUESTION 97. Measurement of energy in a 3-wire circuit from a 4-wire wye system cannot be made accurately with a single element meter, due to the unbalance of voltage in such circuits. A standard 3-phase, 3-wire meter can be used if the load warrants the expense, or the two element network meter is sometimes used on smaller loads. The meter current coils are placed in the two phase wires (not in the neutral) and the common potentials or load potentials are connected to the neutral of the wye.—L.R.T.

A. TO QUESTION 97. Although the meter mentioned in the question looks like a three phase meter, it is not exactly the same, but is designed particularly for network use.

On a service fed from a single transformer, the three wire, single phase meter is used. On a service (even though it is rated as a three wire single phase service) fed from a network system, the three phase or network type meter is used.

The reason for the use of this particular type of meter is to gain accurate registration as the three wire single phase meter will not register accurately any two wire load on this service.

The three wire single phase service fed from a network system has a voltage of approximately 200 volts between phases and 115 volts from each phase to the neutral. When a two wire, 115 volt load is used on a three wire, single phase meter, the registration is inaccurate due to the fact this type of meter only has one potential coil with a voltage impressed across it of approximately 200 volts. It is necessary to use a meter with two potential coils. This can be further demonstrated with the following diagram and description of diagram.

Description: Single phase meter—115/230 volts. Has two current coils

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IF YOU want to make more profit on capacitors with less investment in stock on the shelves, you will do well to standardize on Mallory Universal AC Capacitors. The Mallory line is complete—meets every requirement for both round and square types.

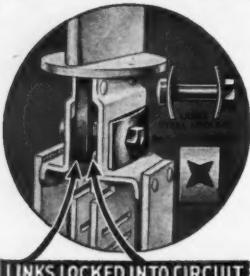
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INSULATION and WIRES, Inc. • 2127 Pine St., St. Louis, Mo.



Production Lifelines

WARE HI-LAG



LINKS LOCKED INTO CIRCUIT

NON-HEATING CONTACTS

Keep Motors Humming

- End Over-Heating
- Stop needless fuse blowing
- Time-Lag 2 to 5 Times Normal Current
- Certified to Comply—Federal Specification W F 803a-Type II

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4410 W. Lake St. Chicago, Ill.

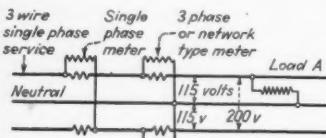
WARE
Renewable
HI-LAG FUSES

Reader's QUIZ

[FROM PAGE 113]

and one potential coil rated at 230 volts but this coil only has a line voltage of approximately 200 volts.

Three phase or network type meter—115/230 volts. Has two current coils



and two potential coils each rated at 115 volts.

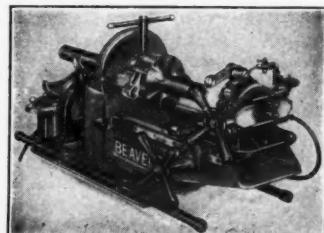
Load A—A resistance load of 5 amperes at 115 volts. Power factor would be unity or 100 percent. No line loss in voltage.—C.J.R.

A. TO QUESTION 97. The reason power companies use a two-element type meter on a single phase 3-wire service derived from the neutral and two of the phase wires of a 3-phase, 4-wire system, is because of the phase differences of the voltages in the latter type system.

On such a circuit there is only 208 volts between each of the "hot" wires instead of 240 volts, as in the regular 120/240 volt, three wire system. A little reflection would show that if an ordinary 1-element, single phase, 3-wire meter were applied to such a circuit, the customer would be receiving all the benefits of 240 volt service, while paying for only 208/240 of it. This amounts to about 13.4 percent loss to the power company, assuming that the voltage is the same each side of neutral. In this type of meter the potential coil is wound for 240 volts, is connected to the two "hot" wires and in this case would have only 208 volts impressed on it. Yet the line to neutral voltages are the same as in the regular type circuit. If the line to neutral voltages are unbalanced the error would be more or less, depending of course on the degree of unbalance of voltage and the load. For this reason alone, 2-element meters are sometimes used on important loads on the regular 120/240 volt, single phase, 3-wire systems.

In the 2-element, single phase, 3-wire meter, each potential coil is wound for 120 volts. One lead of each coil is connected to its respective "hot" wire while the end leads join together connecting to the neutral wire. This makes each element take care of one side of the circuit correctly under all conditions.—D.B.P.

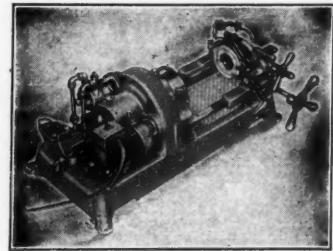
The A-B-C of . . . Pipe and Bolt Machines!



Beaver Model-A

A high-speed heavy-duty deluxe Pipe and Bolt Machine. Range $\frac{1}{8}$ to 2-inch up to 12-inch with geared tools and drive shaft. Bolts, $\frac{1}{4}$ to 2-inch. Wt. 415 lbs.

Write for Bulletin A



Beaver Model-B

A light-weight utility Pipe and Bolt Machine combining many features of Model-A with the easy portability of Model-C. Range $\frac{1}{8}$ to 2-inch up to 8-inch with drive shaft and geared tools. Bolts up to $1\frac{1}{2}$ -inch. Weight 280 lbs.

Write for Bulletin B



Beaver Model-C

A STURDY LITTLE POWER UNIT Converts hand pipe tools into power tools from $\frac{1}{4}$ to 8-inch. Threads 8-inch in 6 minutes. Threads bolts up to $1\frac{1}{2}$ -inch. Two men can work at the same time without interference. Weight 150 lbs.

Write for Bulletin C

Write for new Tool and Machine Catalogue—Just off the press

**BEAVER
PIPE TOOLS**

642 Deen Ave., Warren, O.

RESIDUAL MAGNETISM REVERSED

QUESTION 98. We have a 125 kva. synchronous motor driving an air compressor. On several occasions the residual magnetism of the exciter has been reversed upon starting after being shut down for repairs. What would cause this? The machine rating is 125 kva., 2,200 volts, 3 phase, 25 cycles, 250 r.p.m., exciter 125 volts, d.c., 40 amperes, 1,150 r.p.m.—W.R.T.

A. TO QUESTION 98. It was not stated in this question whether the d.c. exciter was shunt or compound wound. It is quite common for a compound wound exciter to reverse polarity if the synchronous motor field is not opened before the motor is removed for the a.c. supply. This is due to the fact that the energy stored in the field will kick back through the compound winding which will re-magnetize the exciter field in the opposite direction causing a reverse of polarity.

A shunt wound exciter may reverse polarity and this is usually caused by the fact that the electrical brush neutral and mechanical brush neutral do not coincide, so that as speed and load decrease, the kick from the motor field would tend to magnetize the shunt field in the opposite direction whereas this would not happen if the neutral plane of the brushes was the same at rest as when the machine is in motion.

The way to correct this would be to remove the load on the synchronous motor, then open the field circuit and finally disconnect the motor from the line.—M.A.T.

A. TO QUESTION 98. I had trouble like this several years ago. I had three machines, two had shunts across series fields which did not cause any trouble, but one without shunt gave quite a little trouble reversing fields. This reversal is caused by a kick-back from synchronous fields. Keeping commutators on exciter in good shape helps a lot but best way is to put a shunt resistor across series field that will carry about 10 amps.—F.A.

A. TO QUESTION 98. If when the synchronous motor driving the air compressor is stopped, the starting switch should short circuit the exciter, the residual magnetism of the exciter would be reversed. It would be desirable to check on the connections and see if there is a possibility of such an occurrence.

A second possibility is with a com-



Write for FREE Catalogue



JOHNSON BRONZE

Sleeve BEARING HEADQUARTERS

490 S. MILL STREET • NEW CASTLE, PA.

THESE 2 CATALOGS
WILL SAVE YOU
Time . . .

- They enable you to order carbon brushes quickly and unerringly—by catalog number. No. 8 covers *industrial* machinery, including rotaries, welders, and a variety of industrial motors. No. 7 covers *mine* equipment, such as coal drills and loaders, locomotives, motors and generators. These catalogs contain *reference data only*—no selling arguments. Your letterhead request will bring either or both . . . Superior Carbon Brushes embody 24 years' specialization.

SUPERIOR CARBON PRODUCTS, INC., 9113 George Ave., Cleveland, Ohio



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BRUSHES

Install
JOHNSON
Leaded Bronze
BEARINGS

In order to get the maximum power from a motor, it is necessary to have it equipped with bearings that assist . . . not retard it. The special high-lead bronze in Johnson Bearings enables the motor to operate at full efficiency. Johnson Electric Motor Bearings are available from stock for more than 250 different motors. Try a set on your next overhaul. Check them and see if they don't enable you to get the MOST from your motors.

Two catalog covers for Superior Carbon Brushes. The top cover is labeled 'INDUSTRIAL' and the bottom cover is labeled 'FOR MINING EQUIPMENT'. Both covers feature the Superior Carbon Brushes logo and some descriptive text.

"National SN"

BUS DROP CABLE



Designed for branch circuit runs from the plug-in devices on busway systems, wireways and other raceways to machine tools and other similar applications.

1. Saves rubber. Insulation and jacket made entirely of "National SN" thermoplastic material.
2. Eliminates steel. No conduit required for branch circuit from the bus plug-in device or feeder raceway to the machine.
3. Eliminates special fittings. Standard National Electric EZ Armored Cable Connectors used as box connections.
4. Fire-resistant. "National SN" thermoplastic material will not burn.
5. Highly resistant to oils, acids, alkalis, moisture, cutting and cooling fluids, and mechanical abuse. "National SN" Bus-Drop Cable renders maximum serviceability at minimum cost per machine.

National Electric
PRODUCTS CORPORATION
Pittsburgh Pa.

Reader's QUIZ

[FROM PAGE 115]

pound wound exciter. If the exciter shunt field is opened the series field if differentially wound could cause the reversal.—J.E.W.

Can You ANSWER these QUESTIONS?

QUESTION A4—We have a 1200 kw., 230 volt M-G set which is more than ample for our direct current needs. My problem is to eliminate a 125 volt, 40 amp. M-G set and use the excess power from my 1200 kw. set to excite a 400 horsepower synchronous motor which uses the above 125 volt, 40 exciter amp. How can this be done?—R.F.M.

QUESTION B4—I have an Edison nickel-iron-alkaline storage cell type A-6 used with an instrument to measure low values of resistance and have quite a problem charging this cell. A 60 minute charge at 90 amperes is recommended for boosting, but a rate of 45 or more amperes is normal.

We have several sources of direct current at 600 and 125 volts but no practical means of using it for this purpose. On several occasions I have put this cell in series with a synchronous motor field with the proper current, but due to the necessity of shutting down to make the connections it is not a very desirable method.

Can you suggest a method of getting 90 to 100 amperes direct current at 1.5 to 2 volts?—E.J.K.

QUESTION C4—In a power plant we have run a 4-in. transite conduit about 100-ft. long in the basement slab, which is 4-ft. thick, and full of reinforcement steel. During the construction period we made a sharp change in direction of this conduit, and as we had no transite elbows we cut a section of old duct elbow and inserted this in the run. The largest thing we can get through this conduit is a 4-in. steel fish wire. We know that this conduit lays about 3½-ft. below the surface of the slab, and we assume that this section of duct has collapsed during the under slab grouting process as it was clear and full diameter up to this time. It is imperative that we clear this conduit and we cannot locate this stoppage close enough by measurements. Can anyone suggest a method that we can use in locating this spot so that we might get to it without removing too much concrete?—R.M.

PLEASE SEND IN
YOUR ANSWER BY JULY 1

Best Answer to War-Time Demands

INSTALL

RICO
REG. U.S. PAT. OFF.

RENEWABLE FUSES
With the famous Powder-Packed Element

KLIPLOK CLAMPS
Lock fuses and clips together

KANTARK FUSES
With genuine fibre tubes (not paper)

COLORTOP PLUG FUSES
The color tells the size

FUSE PULLERS
Pull and replace fuses safely

OILERS

Glass and Unbreakable types for every application. Stops guesswork - bearing failures - waste - idle machinery, etc.

WRITE FOR FOLDER No. 300

TRICO FUSE MFG. CO., Milwaukee, Wis.
In Canada: IRVING SMITH LIMITED, Montreal

The Jiffy Line

Established 1915
of Labor Savers



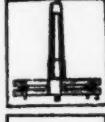
JIFFY PIPE BENDER VISE

Bends ½" and ¾" conduit vertically or horizontally. Offsets, saddles and difficult bends made accurately and easily. 2" capacity vise.



JIFFY ADJUSTABLE HOLE CUTTER

One size cuts perfect round holes ¼" to 6" dia. in boxes, panels, switchboards, etc. Spring pressure does all the work. Can be used in close quarters. Drill Press Type. Two sizes ¼" to 3" and 1½" to 6" holes.



JIFFY SOLDER DIPPER

Practical tool for wiremen. Saves solder.

• Satisfaction Guaranteed



JIFFY SNAP-IN BLANKS

close up knock-outs in service and outlet boxes. Rust-proof neat—one piece. Approved.

Write for Jiffy Catalog

CLYDE W. LINT CO.

100 So. Jefferson St.
CHICAGO 6, ILLINOIS

**Power and Light for
Shipbuilding**

[FROM PAGE 51]

a shop building. Some 250 reflectors had to be painted and correctly positioned; almost 100 others had to be replaced. Another group of more than 400 open type 1,500-watt units, used for portable and temporary purposes, also had to be painted and readjusted. Approximately 1,000 lensed floodlights, 1,500-watt units are included in the permanent yard installation. Most of these are equipped with Alladin louvers.

Mounted on 60-ft. wood poles, the average flood bank comprises eleven units on two crossarms, although some poles have as many as 20 units. The regular street lighting system of about 150 units is turned on and off automatically by means of a photo-electric cell relay. Even an overcast or foggy day will turn on these lights.

Night welding presented still another problem. Fortunately more shipbuilding is done under roof at the Marinship yard than in the average. Outdoor skids, however, on which welding is done on prefabricated sections, were equipped with rolling shed-like structures. Sheds were built on wheels and may be rolled back and forth on rails. The high intensity welding flashes are thus confined under roof. The sheds also enable welders to work during rainy weather.

Further economies were effected by using Transite duct lines supported on a redwood plank with a redwood separator, like an inverted T. The wood plank "floats" the conduit in the earth, buried about 3 ft. below the surface. Paper insulated, lead covered cables were used for further conservation of rubber. This method saved labor, materials and time, all of them important in wartime.



NEW OFFICERS of the Minnesota Electrical Inspectors Association elected at the N.C.E.I. convention session of that group are (L to R) W. L. Wadsworth, vice-president; Walter H. Hackett, president; and Glenn Rowell, secretary-treasurer—all from Minneapolis.

NEW *Weatherproof Dustproof Enclosed Floodlights*

FOR OUTDOOR WORK OR PLANT PROTECTION LIGHTING

OAMCO Enclosed Floodlights are designed and constructed to light large areas with maximum efficiency. Engineered for use in such places as shipyards, outdoor aircraft production lines, loading platforms or for plant protection, these versatile, thoroughly protected floodlights will fill almost any outdoor need to be found in industries producing critical war materials.



Designed for the 300-500 and the 750-1000 watt lamp. Equipped with both type brackets.

Built-In Features of **OAMCO** Enclosed Floodlights

- 1 A steel reflector, porcelain enameled green outside, white inside—easy maintenance.
- 2 A heat resisting convex lens attached to the reflector by a quick detachable ring—dust tight and weatherproof.
- 3 Cast brackets with weatherproof finish for either cross arm or pipe mounting—made for hard usage.
- 4 Cast wireway entrance fitting with weatherproof finish—easy wiring.

Send today for complete information on this new OAMCO line.

RIGHT LIGHT SINCE 1902

OVERBAGH & AYRES MFG. CO.

MEMBER OF THE ELM STANDARDS INSTITUTE

411 SOUTH CLINTON STREET • CHICAGO

Modern Lighting

HIGH BAY FLUORESCENTS IN A REPAIR SHOP

The modern electric repair shop is as fussy about its lighting as the work it turns out. The quality and quantity of the work done depends upon the quality and quantity of the illumination under which it is performed.

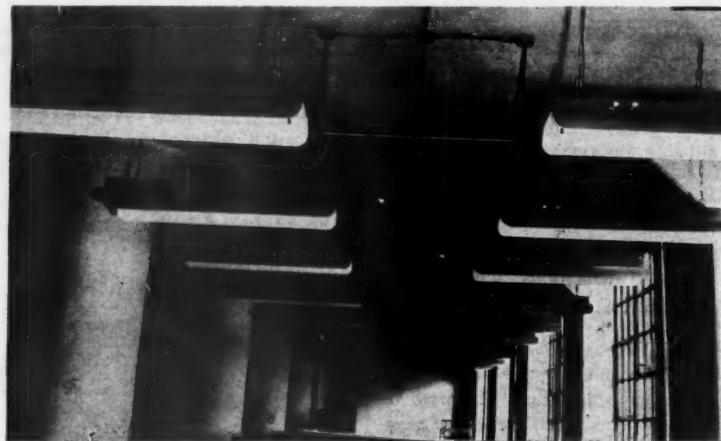
Working on this theory, the work area in the Westinghouse Mfg. & Repair Shop, Cleveland, Ohio, is bathed in an average of 35 foot-candles of cool, evenly distributed light from fluorescent units mounted 30-ft. above the floor. Each unit is equipped with two 100-watt, 3500 degree white lamps. Fixtures over the machines at the sides (see photo) are mounted close together with a third row down the center to even out the illumination at the working plane. Lateral rows of units are on 12-ft. centers and mounted on rigid conduit circuits above the craneway.

Also contributing to the effectiveness of the lighting system is the good house-

keeping practiced in the shop. Light painted steel work and clear, clean floor areas do much to reflect the light where it is needed.

SMALL PARTS ASSEMBLY

Radio parts are small and shiny. Surfaces are plated and consequently are highly reflective. The assembly of these parts can cause bad eye strain and fatigue, if illumination is not correct and plentiful. Eye strain means less production and it becomes a decision of economics—since production is known definitely to increase with increased lighting levels and reduced eye fatigue. Hammarlund Manufacturing Company in their recent expansion program, have taken over more floors in the building which their plant and offices occupy in part, in mid-Manhattan, New York City. The incandescent lighting which consisted of reflectors and 150-watt bulbs was given careful consideration,



SUCCESSIVE SECTIONS of six fixtures each take off the three phase feeder in a repetitive sequence to properly balance load.



NO HARASSING SHADOWS or dark corners annoy the workmen in this repair shop. High bay fluorescent lighting provides 35 foot-candles of maintained illumination on the working plane.

but finally discarded because of low foot-candles, measuring less than 10. Larger bulbs were tried for increasing foot-candle levels but glare from the small shiny parts proved this prohibitive. The incandescent units were removed along with the old wiring but conduits remained and were utilized for the three phase rewiring for fluorescent fixtures.

From the splice box in the center of each building section which formerly fed the open reflectors, half-inch EMT was run to six surface outlet boxes for mounting six two-lamp fluorescent fixtures accommodating 40-watt tubes. Mounting distances were 6-ft. by 7-ft. 4-in. centers, 9-ft. above the floor or 6-ft. above the assembly bench level. Each section containing six fluorescent units is fed from one phase on one fuse.

Proceeding down the bay, the sections take off the three phases in sequence. The circuits, sub-panels and main distribution panel are color coded in order to properly balance the three phase load.

We turned it inside out

FOR BETTER LIGHT... EASIER MAINTENANCE



HERE'S THE DIFFERENCE

The new globe is perfectly smooth on the outside while the inside is finished with a uniform pattern of rectilinear configuration, through which light rays are diffused. The result is a globe of brilliant and sparkling appearance that transmits light with maximum efficiency.

It's the new *Smooth Surface* Reflectolux street lighting globe—an exclusive Westinghouse development.

This newly designed globe differs from all others by having the rectilinear configuration for light diffusion on the *inside* of the globe. The advantages are twofold:

1. Because its smooth exterior surface retards the collection of normal dust and dirt, rated light output is maintained over a longer period of time.

2. Because there are no grooves in which smoke and grease film can accumulate, the time required for cleaning and drying is reduced by as much as 50%. No scrub brush

is necessary; a damp sponge handles the job.

The new *Smooth Surface* globe, of pressed construction, has high, uniform mechanical strength with a chip-resistant fitter edge for added structural support. The globe is available in two sizes—long and short. Both types are interchangeable with present Westinghouse Reflectolux glassware.

For more complete information on the new *Smooth Surface* globe, write Westinghouse Electric & Manufacturing Company, Edgewater Park, Cleveland, Ohio.

"Tune in the Westinghouse Program, Starring John Charles Thomas, Sundays, 2:30 P.M., E.W.T."

Westinghouse

PLANTS IN 25 CITIES... OFFICES EVERYWHERE

Lighting Equipment—



Molded Bakelite with patented threaded shank

This molded weatherproof socket is unusually useful in many types of permanent or temporary installations. Standard guards and reflectors can be attached with weatherproof socket fitters. Leads available in different lengths from 6 in. to 36 in. are permanently molded in the bakelite body. The $\frac{1}{2}$ inch pipe threaded shank molded integral with the body is a patented feature that permits mounting in Pylet conduit hubs, steel knock-out boxes, rigid conduit couplings, or in $\frac{3}{4}$ inch garden hose. The threaded shank seals the installation. Use Type HL-50 indoors or out, for portable hand lamps, cluster lights, lamp or attachment plug outlets, and any similar work needing a rugged, heavy-duty outlet.

Also made as Type HL-5 weatherproof socket without pipe thread shank.

Consult your Pyle Catalog 1100 for complete listings.



The Pyle-National Company
1344 N. Kostner Ave. • Chicago, Ill.

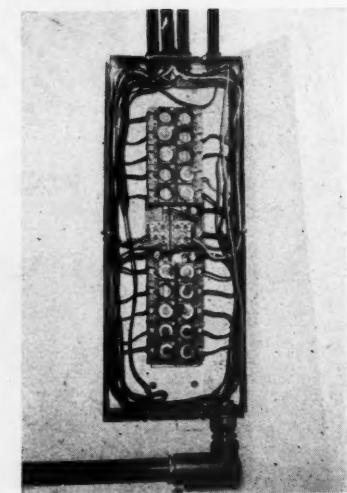
Modern Lighting

[FROM PAGE 118]

and to facilitate maintenance. By proper balancing of load and use of two-lamp ballasts, stroboscopic effect has been minimized.

Experimentation has indicated that one daylight tube and one 3500° white tube in each fixture gives the best quality illumination for this particular type of application where many small shiny parts are handled.

The end result of this modern lighting installation has been glareless, evenly distributed, high foot-candle level illumination, which is expected to "settle down" no lower than 50 foot-candles at bench height. The blending of two different color tubes has brought much good comment from the employees who state that the illumination is much easier on the eye and less eye fatigue exists than when two identical tubes are used. Employees have been given every consideration in obtaining the best il-



SUB-FEEDER PANEL which is color coded to aid proper balancing of load and facilitate maintenance.

lumination available. Maintenance superintendent Frank J. Richter believes that for illumination in the assembly of the small shiny parts which go into radio manufacture, they have found the answer in blended fluorescent.

BETTER LIGHTING MORE PRODUCTION

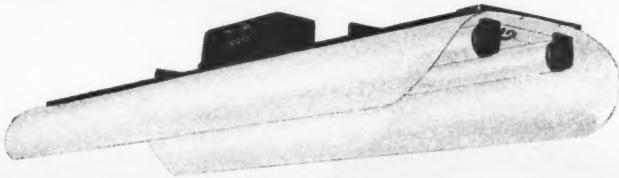
A Southern California plant manufacturing accessories of aircraft have speeded up production considerably through increased lighting levels. Two-hundred seventy-five Westinghouse fluorescence luminaires, each housing two five-foot 100 watt tubes provide approximately 40 foot-candles of evenly distributed glareless illumination on

working levels. Two lamp ballasts in each fixture minimizes stroboscopic effect.

Fixtures are mounted on 10 foot centers, approximately 11 feet 9 inches above the floor. The new fluorescent installation supplants a system of incandescent units which yielded 25 foot-candles at 50 percent more wattage. Fluorescent fixtures were mounted on existing outlets by the Newberry Electric Company, Los Angeles electrical contractors.



FLUORESCENT FIXTURES mounted on existing outlets of previous incandescent system. An increase of foot-candles to 40 from 25 has been obtained at one-third less power.



New Fluorescent Luminaires

SPEEDS PRECISION WORK . . . REDUCES SPOILAGE

Where dimensions and tolerances are measured in *ten thousandths* of an inch, a mere shadow can mean the difference between the right specifications . . . and spoilage.

That's why glareless, shadowless illumination is so necessary for maximum war production of precision parts and assemblies. In fact, good lighting helps all production, whether in foundry, factory or office.

New Westinghouse Luminaires give this kind of lighting—the high-visibility, modern illumination you need, and they comply with Limitations Order L-78.

The moisture-resistant, nonmetallic reflector is covered with a multi-coat, polymerized finish which provides

a reflection factor of 85% or more. And it requires only a "twist-of-the-wrist" to attach or remove this reflector, making it easy to keep clean and at top efficiency. The ballast, now externally mounted, provides power factor ranging from 92 to 99%.

These new Westinghouse Luminaires are available for 2 or 3 lamp, 40-watt and 100-watt, individual or continuous strip installations. Any one of 117 Westinghouse Electric Supply Company Offices and Independent Westinghouse Lighting Distributors will gladly give you full details regarding these luminaires and their installation. Or write Westinghouse Electric & Mfg. Co., Edgewater Park, Cleveland, Ohio, for booklet B-3265.

"Tune in the Westinghouse Program, Starring John Charles Thomas, Sundays, 2:30 P.M., E.W.T."



Westinghouse *Lighting Equipment—*

Plants in 25 cities . . . Offices everywhere



LIHTING MEN have long realized their responsibility to America at war. They have helped to add countless man hours to factory production through improved seeing conditions.

Fully aware of the effect of lighting on production, safety, spoilage, health and morale . . .

Fully aware of the fact that lighting equipment uses critical material . . .

And fully aware of the ways and means of getting the most out of present lighting equipment . . . these men are working with their war-plant customers to help them in every way possible.

Among the things they are recommending and helping their customers to do are:

—*Cleaning bulbs and reflectors on a regular schedule.*

—*Cleaning walls and ceilings—paint if necessary—to reflect all possible light on to the working plane.*

—*The proper placement of fixtures so that shadows on the work are eliminated.*

—*Shading of bare bulbs to cut glare to a minimum.*

—*All of those things that improve seeing conditions with a minimum use of critical materials.*

Some people call it conservation. Others call it making the most of what we have. Another name for it is just plain Yankee ingenuity. Whatever you call it, it's the way the Lighting Man is discharging his responsibility to America at war.

"SIGHT FOR VICTORY" This month the whole lighting industry is cooperating in an effort to help all war plants—large and small—do these things:

1. Check their seeing conditions.
2. Get the most out of present lighting equipment.

A booklet, "Sight for Victory" and a time-saving light-sight check sheet has been prepared by the National Better Light-Better Sight Bureau. If you haven't heard about it, write for further information to National Better Light-Better Sight Bureau, 420 Lexington Avenue, New York, N. Y.



GENERAL  **ELECTRIC**

Safeguard

• LIFE
• PROPERTY
with MCGILL
Vaporproof Safety
Guards



the Guard with the Seal-Tight Globes

Where there is a possibility of fire, or other disaster from a spark, exposed flame, heat or breaking of bulbs, then MCGILL Vaporproof Lamp Guards should be used on all portable or extension lights. The tight-sealing globe and heavy cage, with air-tight seal in handle opening, eliminate these hazards at every spot where this guard is used. These Vaporproof guards are designed to stand up under roughest use and abuse.

These guards also protect the light bulb and prevent breakage when used around machines where water and oil might splash on the bulb. Guards also are grounded—an additional safety feature.

ASK FOR LITERATURE

MCGILL MANUFACTURING CO., INC.
Electrical Division
Valparaiso, Indiana

MCGILL



EXCELLENT EXAMPLE of quality illumination for machine shop operation where close tolerances are required. Measurements showed initial intensity at working levels to be 50 foot-candles provided by high intensity mercury lamps.

Lighting A STEEL PLANT

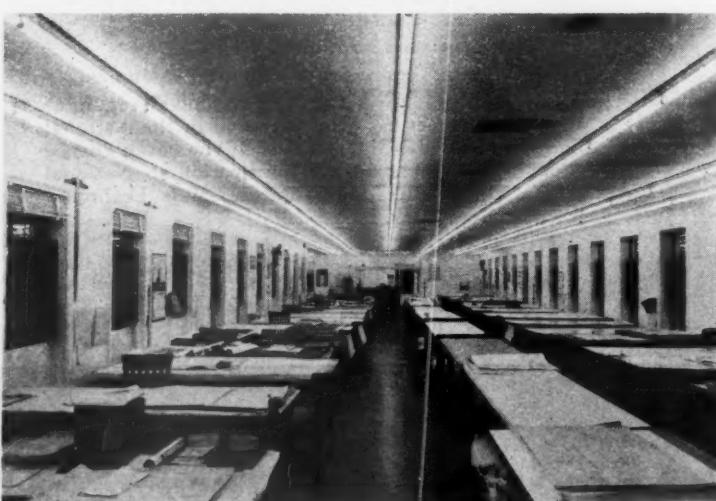
PROBLEM: To furnish a high level of illumination both in the drafting department and in the machine and welding shops. In the drafting room, a long narrow space, economy and minimum use of critical materials. In the shops high bays with craneways necessitate high mounting of units, yet the need for precision workmanship at machine level requires ample, glare-free illumination.

CONSTRUCTION DATA: Drafting room is 98 ft. long, 28 ft. wide, 10 ft. ceiling, finished in flat white. Heavy machine shop is 800 ft. long, 75 ft. wide, with steel trusses 40 ft. above floor. Light machine shop and welding shop combined are of similar length, but slightly lower ceiling.

SOLUTION OF PROBLEM: Drafting room illumination is provided by installation of six

continuous rows, each 98 ft. long, a total of 137 40-watt fluorescent lamps, mounted on metal troughing containing the auxiliaries, using the painted ceiling as the reflector. Machine and welding shops are lighted by 400-watt mercury vapor lamps in high bay units. Heavy machine shop contains 372 units on 12-ft. by 12½-in. centers, mounted 38 ft. from the floor. In the light machine shop there are 208 units, spaced on 12½ by 13-ft. 5-in. centers, mounted 32 ft. high. In the welding shop 99 units on 12½ by 17-ft. 9½-in. centers, 32 ft. high. Previous incandescent lighting system on much wider centers, was left in place as an emergency lighting system.

RESULTS: In the drafting room and heavy machine shop the illumination level is 50 ft.-candles initially; in the welding shop 30 ft.-candles.



EVENLY DISTRIBUTED and glareless illumination is essential in engineering and drafting rooms. An initial intensity of 50 foot-candles is provided by these six lines of 40-watt tubes mounted on flat white ceilings without reflectors.

FOR MORE LIGHT

...without extra fixtures

...without increased wattage

...without costly maintenance

Consider BIRDSEYE'S

Remarkable Invention

CLARENCE BIRDSEYE, famous inventor of quick-frozen foods, designed a revolutionary new kind of lighting . . . to provide more "light for seeing" without added line load . . . to eliminate the costly maintenance required by inefficient bulb-and-reflector combinations.

The Birdseye Reflector Lamp he designed is a complete luminaire lighting unit in itself with its own perfect reflector built into the bulb. Precision-focussed for accurate light control, it requires no fixtures for maximum efficiency. Furthermore, its sealed-in, pure silver reflector never needs cleaning or adjustment.

Leading American manufacturers have enthusiastically adopted this long-sought improvement in industrial lighting after exhaustive tests in use. Allis-Chalmers, Bliss & Laughlin, Curtiss-Wright, Delco-Remy, General Motors, Johns-Manville, Republic Steel, A. O. Smith, Vultee Aircraft, Willys-Overland—to name just a few—use Birdseyes to project "more light per watt," full force and without waste, to the work area. For complete information write today for Booklet M6.

BIRDSEYE REFLECTOR LAMPS



For flooding the working area with brilliant, evenly distributed illumination.



For high-powered, high-bay mounting to penetrate distance, smoke, etc.



For supplementary and high intensity lighting of small areas and machines.



INDIRECT
For soft, even, shadowless, glareless, illumination in indirect lighting fixtures.



BIRDSEYE'S

2-in-1 LIGHTING

A Perfect Combination
of Lamp and Reflector

1. **PURE SILVER REFLECTOR LINING** is sealed inside bulb. Dust, dirt, smoke and fumes cannot reach it. A mathematically correct parabola, it projects light out of the bulb as straight lines, without waste.

2. **PRECISION-FOCUSSED FILAMENT** assures efficient reflection of maximum light, full force, direct to the work area.

3. **NECK REFLECTOR DISC** eliminates "cycling loss" by redirecting and putting to use light that would otherwise be wasted through neck of bulb.

WABASH APPLIANCE CORP.
345 Carroll Street, Brooklyn, N. Y.

EQUIPMENT News

THESE ANNOUNCEMENTS of new equipment are necessarily brief—for more detailed descriptions, sizes, prices and other data write to the manufacturers' advertising departments, tell them in what issue of ELECTRICAL CONTRACTING you saw the item and they will send full details to you.

Fluorescent Reflectors

Announcement has been made of two new "Victory" reflectors made of Silv-A-Tex, a sturdy composition that resists heat, moisture and corrosion. It conforms to WPB Order L-78. The reflecting surface is finished with high-gloss, chip-proof, baked white enamel. Units are made for either chain or rigid suspension in two models, a two or three lamp, 40 watt unit and a two-lamp, 100 watt unit. Bright Light Reflector Company, Inc., Metropolitan and Morgan Avenues, Brooklyn, N. Y.



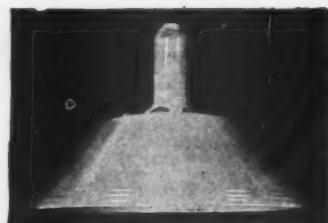
BRIGHT LIGHT FLUORESCENT REFLECTORS

Fluorescent Units

This line of fluorescent units has been redesigned to comply with WPB order L-78. The non-metallic reflectors are removable without turning off current or removing lamps. By loosening two wing nuts, the reflector lifts off from top of wiring channel. Another feature is the "V" shaped wiring channel. It separates the two 40-watt lamps and eliminates light absorption. Units are two 40-watt or 100-watt lamps. They are available for continuous line lighting or individual four-lamp models. The Fostoria Pressed Steel Corp., Fostoria, Ohio.



FOSTORIA FLUORESCENT UNITS



WAKEFIELD COMMODORE REFLECTOR

Industrial Reflectors

A new line of Plaskon industrial reflectors has been announced. It consists of a series of 15- and 19-inch reflectors for lamps from 200 to 500 watts. Known as the Commodore industrial unit, a sufficient amount of light is allowed upward to illuminate the ceiling area to avoid lighting contrasts. The reflectors are supplied with a husk with a $\frac{1}{2}$ -inch iron pipe size female cap which can be mounted on pipe, box or with a strain relief, on cord. One 15-inch size is equipped with a socket adapter so that it can be screwed into any existing socket. The F. W. Wakefield Brass Company, Vermilion, Ohio.



SPERO MARINE FITTINGS

Marine Fittings

A complete line of 9S Series of metal enclosures and accessories in accordance with Navy specifications has been added to this line. These Navy boxes are available in 3-, 4- and 5-inch sizes, watertight or non-watertight, with the following devices: double pole, three pole, two-circuit and three-way switches; plug receptacles; pushbuttons; branch and junction boxes. The Spero Electric Corporation, 18220 Lanken Ave., Cleveland, Ohio.



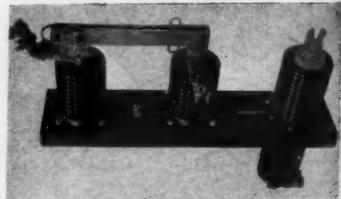
WESTINGHOUSE ELECTRONIC DRIVE

Electronic Drive

A new electronic adjustable-speed drive, known as the Mot-O-Trol, has been announced, for application on industrial drives. Some of the features include stepless speed control, automatic close speed regulation over wide load fluctuations, full torque at low speeds, smooth stepless acceleration and deceleration and dynamic braking. The drive consists of four parts (1) power transformer for separate mounting, (2) Mot-O-Trol cabinet with thyatron-tubes and current limiting and speed regulating control, (3) control station with potentiometer to vary the voltage supplied to the armature and field circuits and with start and stop pushbuttons and (4) shunt-wound, d.c. motor. Mot-O-Trol is designed to automatically regulate a preset motor speed to maintain constant speed regardless of load. A standard drive is available for ratings up to 1 hp. and a speed range of 1 to 20; more powerful drives can be designed to special order, with wider speed ranges. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Switch

A new double throw, 23 kv., 600 ampere switch with positive lock in open position. To prevent operation of double throw disconnects from one to the other position without coming to a full stop in the open position, a positive lock is located at the switch blade hinge end. This stops the blade in mid-position so it is necessary to place a switch stick in hook rings at hinge to release lock before completing travel to other position. Delta-Star Electric Company, Chicago, Ill.



DELTA-STAR SWITCH

DEPENDABLE CONTROL



OF POWER
aimed to destroy
enemy forces

OF POWER
aimed to sustain
our forces

ARROW serves
with dependable SWITCHES

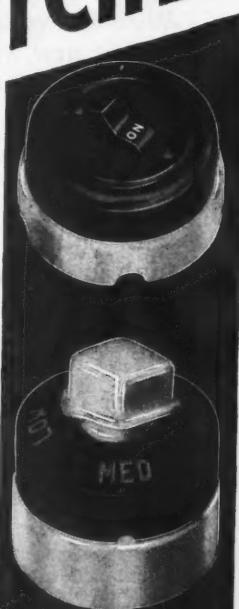


Their
service to the
firing-line stems from flaw-
less service at the production-line.
"Hot wires", heavy loads, round-the-clock
operating schedules, — these demand super-
stamina in switches.

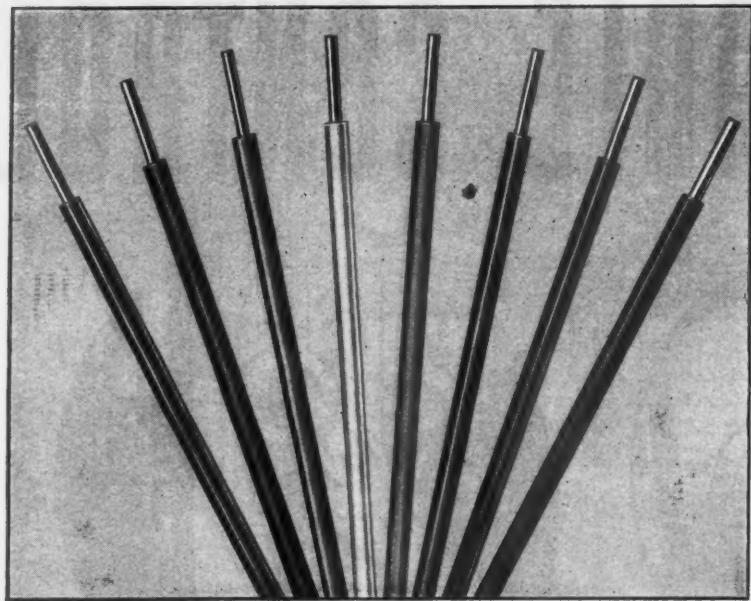
So install or replace with ARROW Switches for
continuous, positive ACTION on production-lines. . .
Heavy-duty controls for lighting and power circuits;
specification-grade T-rated 10, 20 and 30 Amp. "Type
C" Switches, Rotary Snap Switches, Ceiling Pull
Switches, Door Switches, Flush Tumbler Switches with
or without outlet box covers. You'll find in them the
fighting Quality to keep functioning.

DISTRIBUTED THROUGH
ELECTRICAL WHOLESALERS

ARROW ELECTRIC DIVISION



THE ARROW-HART & HEGEMAN ELECTRIC COMPANY, HARTFORD, CONN., U.S.A.



FLAMENOL* BUILDING WIRE

TYPE SN

FOR MAINTENANCE WIRING FOR NEW WAR WIRING AND REWIRING

You can now obtain this dependable, small diameter, synthetic insulated Flamenol Building Wire for your war-purpose jobs — maintenance wiring, new wiring or rewiring. The available supply of resins has improved. They are being allotted for electrical conductor insulation where copper is allocated.

Flamenol's small diameter enables more wires to be used in conduits. Its smooth finish makes wire pulling easy. Its insulation is superaging, high in dielectric and mechanical strength, flame retarding and resistant to oils, moisture, acids, etc. Use it for branch circuits, feeders and special wiring. It is available in sizes 14 to 4/0.

For further information see nearest G-E Merchandise Distributor or write to Section W631-8, Appliance and Merchandise Department, General Electric Company, Bridgeport, Conn.

*Reg. U. S. Pat. Off.

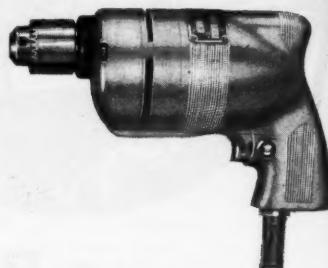
GENERAL  **ELECTRIC**

EQUIPMENT
News

[FROM PAGE 126]

Drill

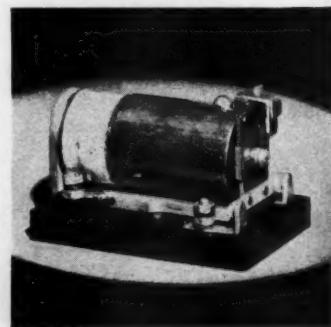
This new $\frac{3}{4}$ -inch heavy duty drill has been especially designed to speed up tough "skin-drilling" in airplane construction but is suitable for production drilling jobs up to $\frac{1}{4}$ -inch in steel and $\frac{1}{2}$ -inch in wood. Known as Model "47" it weighs $3\frac{1}{2}$ lbs. and is $7\frac{1}{4}$ -in. long; $2\frac{1}{8}$ -in. wide. It has diecast body, helical-cut gears and 100 per cent anti-friction bearings. Extra-powerful Universal motor available in four speeds, 1800, 2500, 3500 and 5000 rpm. Two-pole momentary contact switch with lock for continuous operation. Skilsaw, Inc., 5033-43 Elston Avenue, Chicago, Ill.



SKILSAW DRILL

RELAY

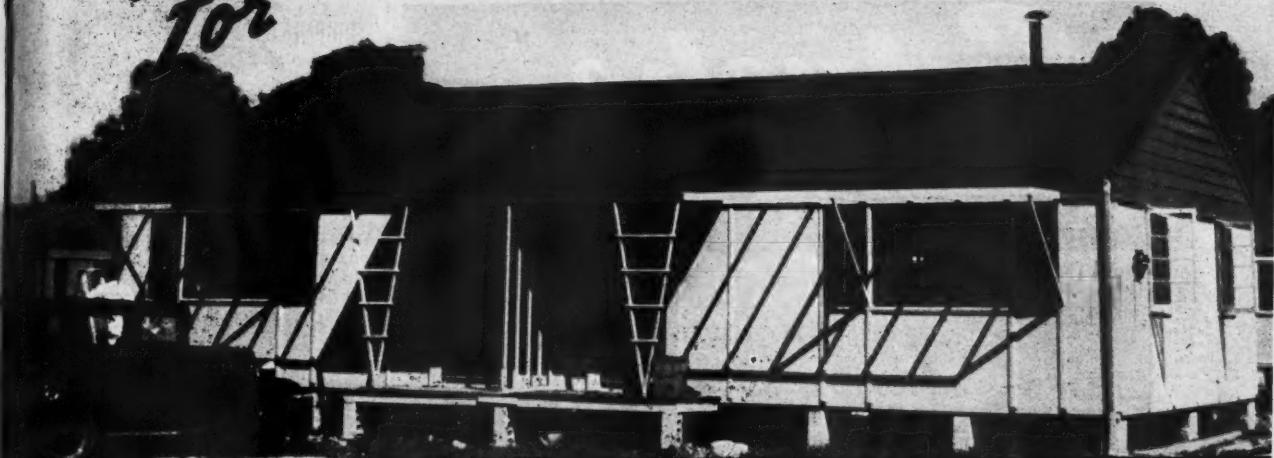
A new time-delay relay, specifically designed for aircraft applications where time-delay drop-out is required, has been announced. It is available in two sizes, one providing up to 0.4 second time delay, and the other up to 0.3 second time delay. Designed for use in a wide range of ambient temperature—from plus 95 C to minus 40 C—both sizes are compact, suitable for mounting in any position, and corrosion proof. The normally closed, double-break, silver contacts of the relays will carry 20 amperes continuously at altitudes up to 40,000 feet above sea level. Also, the operating coils can be furnished for operation on either a 12- or a 24-volt circuit. General Electric Co., Schenectady, N. Y.



G-E TIME-DELAY RELAY

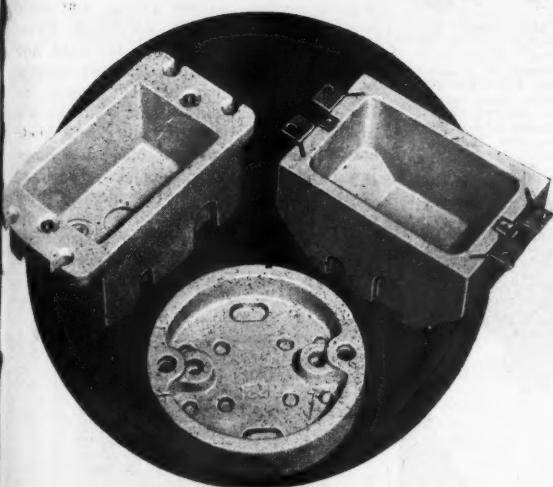
PREFABRICATED HOUSING

for



**PORCELAIN
PROTECTED**

Prefabricated
**WIRING
CONSTRUCTION**



★ The shallow walls of prefabricated houses offer no problem to electrical contractors planning wiring systems. The correct answer is provided by shallow porcelain outlet boxes developed for this particular need and meeting requirements for conservation of critical materials.

Because porcelain is a non-critical material, these shallow porcelain outlet boxes are available in numbers to meet all of your wiring requirements for prefabricated housing. They offer Prefabricators the same well known safety, permanency, simplicity of installation, economy, and insurance against maintenance as standard porcelain wiring products.

Porcelain—or non-metallic type—outlet boxes are required by all Government directives and orders on wiring construction and the companies listed below will be glad to cooperate with you in supplying your needs.

MODERN PORCELAIN PROTECTED WIRING SYSTEMS



★ ILLINOIS ELECTRIC PORCELAIN CO.

★ KNOX PORCELAIN CORPORATION

★ PORCELAIN PRODUCTS, INCORPORATED

Fairfax, Ohio

LATROBE PRODUCTS

★ FLOOR BOXES ★ WIRING SPECIALTIES ★

HIGH
QUALITY

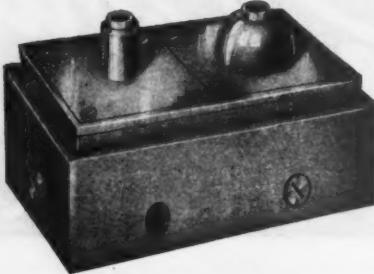
Easy to Install Flexible as to Use

LATROBE Products definitely aid wartime production—
by requiring less time for installation, by giving long
trouble-free service—by wide flexibility as to use—
write for catalog.

EASILY
INSTALLED



D. G. D. P. Glass Insulator attached to No. 403 Insulator Support with No. 450 Wood Pin and Bolt.



Adjustable Gang Box

Gang Box Bodies are provided with solid partitions to separate low and high tension wires. Minimum height to top of Cover Plate is 3½ inches. Box Bodies are 3 inches high.



"B&D" Cleat Attached to "Bull Dog" Support consist of a cross bar with necessary bolts and screws for securing "B&D" Cleats to Bull Dog Insulator Supports.

110 "LATROBE" Watertight Box

Designed to eliminate the use of small screws, receptacle straps, filler plates, etc. Merely attach wires and fasten on cover plate.

470 Pipe Hanger

Pipe support turns freely, allowing pipe to run parallel or at right angles to beam. Does away with drilling or use of straps.

Check your stocks, and let us know your requirements

**FOR BEST RESULTS
STOCK LATROBE PRODUCTS
SELL LATROBE PRODUCTS**

DURABLE

ECONOMICAL



**FULLMAN MANUFACTURING CO.
LATROBE . . . PENNSYLVANIA**

ACME COLD CATHODE LIGHTING TRANSFORMER

Flexitest Cases

The new type FT Flexitest cases for panel mounting combine a relay and knife blade test switches in the same unit. Present standard relay elements are used and are mounted on a removable unit chassis. Test connections can be made either by clip leads or test plug. Test switches are of high capacity, self-aligning knife blade construction with movable blade and hinge jaw mounted on molded block fastened to case. Each circuit can be identified by cards on switch handle and a red handle identifies the trip circuit. Three size cases are available. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.



WESTINGHOUSE FLEXITEST CASES

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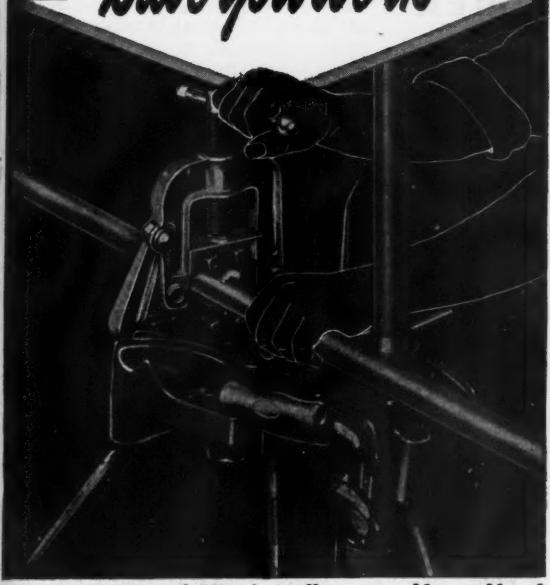
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RIDGID

VISE STANDS

Save You Work



RIDGID Tri-Stand Vise is really a portable workbench

9 Handy Vise Models in 23 sizes

THIS Tri-Stand, for instance, is typical of **RIDGID** Vises in work-and-time-saving features. It's equipped with a 3-size pipe bender, pipe support, tool slots and plenty of room for oil can and dope pot. LonGrip jaws protect polished pipe. Legs fold in for easy carrying to the job—you can screw feet to floor but it "stays put" without that. Ceiling brace screw is standard equipment. Made also with chain vise. Strong malleable construction. Order this handy vise from your Supply House.



It pays you to have this New **RIDGID** Catalog

It illustrates and describes all 9 models—also **RIDGID** Pipe Wrenches, Cutters, Threaders, Reamers & Screw & Pipe Extractors—all with typical **RIDGID** advantages in working pipe and conduit . . . easier better work & longer tool life for your money. Send for a copy now!

Buy **RIDGID** Pipe Tools at
Supply Houses Everywhere



RIDGID

★ PIPE TOOLS ★

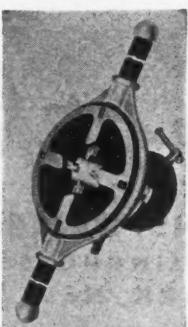
Fast-Working Tools for War...
and the Busy Peace that's Coming



**Set it to size in
10 Seconds**



Only 1 set of high speed
steel dies for 4 sizes of
pipe—and they stay
in the threader.



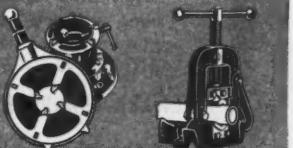
No. 65R is furnished
also in 2-handle model;
also as a plain die stock,
No. 65.

To thread any 1" to 2"
pipe or conduit with the
No. 65R

RIDGID

● No time lost changing chaser dies—1 set of chasers in this remarkable No. 65R assures you micrometer perfect threads on 1", 1 1/4", 1 1/2" and 2" pipe or conduit by a simple 10 second change; no extra sets of dies to bother with. Mistake-proof workholder sets instantly to pipe size, no bushings needed. You'll like the easy floating action, because power is straight line from handle to chasers. A rugged steel-and-malleable tool, trouble-free, durable. As always, it pays you to ask your Supply House for the **RIDGID** No. 65R.

THE RIDGE TOOL COMPANY
FLYRIA, OHIO, U.S.A.



**Standard or special, it's right
if it's a Newark
TRANSFORMER**



Type P
Two to three
phase insulating
transformer, 1.0
to 10 kva. Also
auto transformer,
1.0 to 25 kva.



Type N
Single phase insulating
transformer, 0.050 to
7.5 kva. Auto
transformer,
0.250 to 15
kva.

Newark
TRANSFORMER CO.
17 FRELINGHUYSEN AVE.
NEWARK, NEW JERSEY

**Our Subcontract Division
can help your production**

Experienced engineers, skilled operators, machines and floor space—ready to jump in on your subcontract work. Established long before Pearl Harbor, this division has hung up new production records on general manufacturing as well as electrical work. 'Phone us—**BIGELOW 3-5600.**

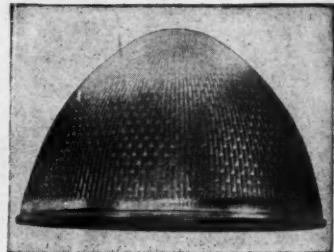
NEWARK TRANSFORMER CO., 17 Frelinghuysen Ave., Newark, N. J.

EQUIPMENT News

[FROM PAGE 134]

Street Lighting Globe

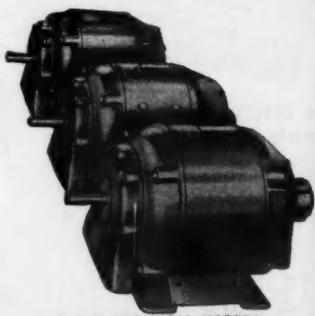
For street and highway lighting, this new smooth surface globe reduces maintenance. Smooth on the outside, the globe is finished on the inside with a uniform pattern of rectilinear configurations, through which light rays are diffused horizontally. The smooth outside surface retards collection of normal dust and dirt. The globe is of pressed construction, resulting in uniform light distribution. It is available in two types, long and short. Westinghouse Electric and Manufacturing Company, Edgewater Park, Cleveland, Ohio.



WESTINGHOUSE LIGHTING GLOBE

Motors

A new line of Uni-Shell electric motors providing interchangeability of all motor types in any one frame size has been developed. All motors are built within cylindrical shells of steel. In any one frame size, the shell dimensions, head fit, bolt circle holes, shaft size and conduit box mountings are identical for all motor types. Standard on all ball bearing motors is the double-row-width ball bearing which has a large grease reservoir and complete seals on both sides that are held in place by removable snap rings. The lubricant is sealed in and the dirt sealed out. Three grades of rotor balance are available on all types of Uni-Shell motors: static balance, commercial dynamic balance and special dynamic balance. Robbins & Myers, Inc., Springfield, Ohio.



R & M UNI-SHELL MOTORS

Colt Quality

A standard of quality built upon generation after generation of skilled workmanship in making Colt Revolvers and Automatics and maintained in Colt Electrical Products.



**Colt Magnetic Motor Starters
with Floating Magnet Action**

Ball Bearing floating action assures positive magnet operation without friction. Combination automatic or hand reset. Ask for copy of COLTALOG which describes this and other Colt Electrical Products.

COLT Engineered MOTOR CONTROLS

COLT'S PATENT FIRE ARMS MFG. CO., ELECTRICAL DIVISION, HARTFORD, CONN.

To Help Workmen

GET THE MOST FROM TOOLS

IT takes tools—lots of them—to win a mechanized war. Every pair of pliers—every wrench—every hand tool that is broken on the home front is a break for Hitler.

To aid experienced electricians and mechanics to get the most out of tools—to help train green hands, too—Mathias Klein & Sons have prepared a pocket-size guide containing valuable information on the care of tools and suggestions for their safe use. This is a contribution we are making to aid fighters on our industrial front in securing the long life and satisfactory service that is built into the quality tools they use. Mail the coupon below for your copy.

ASK YOUR SUPPLIER

Foreign Distributors:

International Standard Electric Corporation, New York



Mathias Klein & Sons

3200 Belmont Avenue, Chicago, Illinois

Gentlemen: Please send me without charge a copy of the booklet "Long Life to Tools."

Name.....

Address.....

City..... State.....



Mathias **KLEIN** & Sons
Established 1857
1200 BELMONT AVENUE - CHICAGO
Chicago, Ill., U.S.A.

EQUIPMENT News

[FROM PAGE 131]

Electric Drill

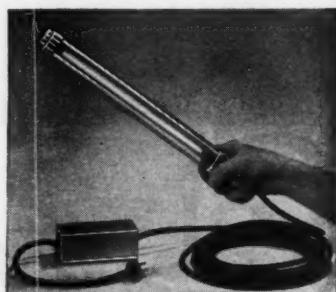
A new plastic Thor $\frac{1}{4}$ -in. capacity electric drill has been announced. Thor "armored in plastic" construction of the new drill, featuring double protection of the operating parts within an inner metal skeleton frame that is covered by separate plastic housings, provides fast drilling. It can be adapted to all types of heavy-duty production service in aviation plants, shipyards, and all other war industries. The plastic housings of the drill—the field case, gear case and grip handle—serve as a protector armor. The drills measure $8\frac{1}{2}$ inches in length and are available in three speeds, 2500 rpm., 3750 rpm. and 5,000 rpm. Independent Pneumatic Tool Company, 600 West Jackson Blvd., Chicago, Ill.



INDEPENDENT PLASTIC DRILL

Inspection Light

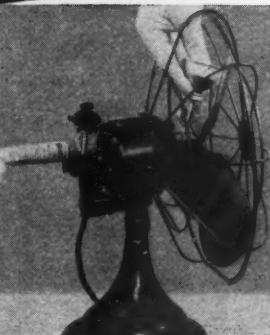
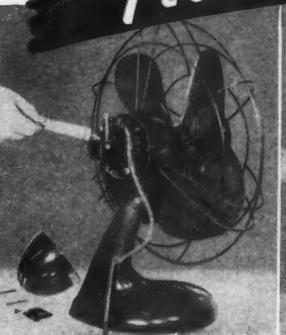
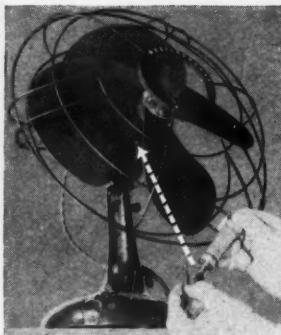
A new fluorescent inspection light has been designed for use in war industries. This portable light is for inaccessible places in aircraft, ships, war tanks and other types of industrial applications, including automobiles, boilers, heavy machinery. The light is taken apart for lamp replacement by removing two screws. Combination metal light baffle and support shields light from inspector's eyes. It comes with standard cord plug and ballast box with 20 ft. of cord. Commercial Reflector and Manufacturing Company, 3109 Maple Avenue, Los Angeles, Calif.



COMMERCIAL INSPECTION LITE

Make your Fans Last.. DO THESE THINGS

1 LUBRICATE



STREAMLINE TYPE

Oil or grease front bearing.

Grease gears and rear bearing.

CONVENTIONAL TYPE

Grease oscillating gears and rear bearing. Oil or grease front bearing.

LARGE CIRCULATOR TYPE

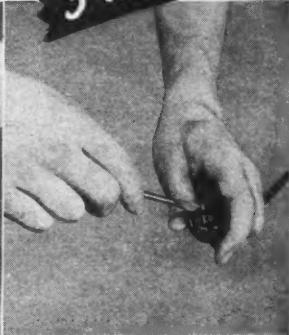
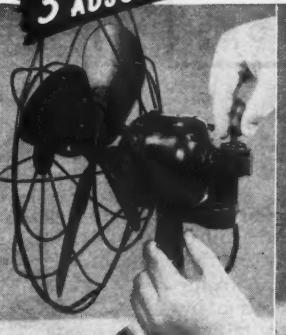
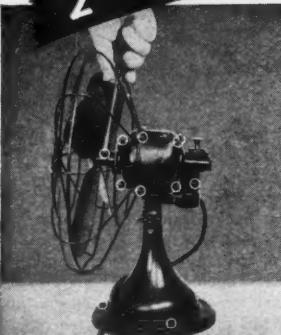
Oil motor at both ends. Grease the oscillating gear.

2 TIGHTEN

3 TEST ADJUSTMENTS

4 CLEAN BLADES

5 CHECK CORD



Tighten set screw in fan blade hub. Also tighten screws or nuts holding fan guard, motor case, and other parts.

Always loosen clamping screws for directional adjustment. Never force by twisting guard.

Accumulated dirt and dust cause blade unbalance, vibration and bearing wear.

Make sure wires are not loose, particularly in plug end. When turning fan off, use switch instead of jerking out plug with cord.

FULL SPEED AHEAD



Westinghouse is now producing more fans than ever—all for shipboard use by the Navy and Maritime Service. With this experience added to an already outstanding record, Westinghouse postwar fans will set a new and higher standard of value.

Always follow the manufacturer's printed instructions. If not at hand, obtain from distributor or manufacturer. Medium-grade machine oil is generally recommended for fans. The distributor or manufacturer will advise what grease to use. Grease for Westinghouse fans can be obtained through your nearest Westinghouse distributor.

Westinghouse *long-life* Fans

SYMBOLS OF SAFETY

Federal *Rolarc*
SAFETY FACTORS

INCREASE PRODUCTION

When a switch fails machines stop—vital war production slows down. And one of the reasons for switch failure is uncontrolled arcing. That's why the Federal 575 Volt Rolarc Safety Switch* is built with special safety features to control and reduce arcing to an *absolute minimum*—and so to increase production by eliminating delays and accidents caused by switch failure.

Two parallel cylindrical rollers fabricated from high arc-resistant material form an insulating barrier to "dam up" and snuff the arc. This gives the Rolarc many added advantages that increase switch safety and service through perfect control of arcing.

Follow the leaders—for extra service and safety switch to Federal.

*100-600 Amperes only.

For Complete Rolarc Data

write for Bulletin 42-12. Contains all the essential facts on the Federal 575 Volt Rolarc Safety Switch.



FEDERAL ELECTRIC PRODUCTS COMPANY

48 PARIS STREET NEWARK, N. J.

PANELBOARDS • SWITCHBOARDS • SAFETY SWITCHES • CIRCUIT BREAKERS

EQUIPMENT
News

[FROM PAGE 134]

Wire Stripper

The "Speedex" wire strippers can be used for removing the insulation from any type of electric wire—solid or stranded. They are made to strip wire sizes No. 8 to No. 30. Hardened steel, precision ground cutting blades strip insulation without marring the wire. They can be used as a production tool or for occasional spot stripping or cutting. Different size cutting blades are interchangeable and can be obtained separately. Wood Specialty Mfg. Co., 919 Taylor Ave., Rockford, Ill.



"SPEEDEX" WIRE STRIPPER

Switch

This unit type S.P.S.T. indoor switch is arranged for angle iron mounting. The terminal arrangement permits taking off cables to the front, rear or top as desired, eliminating back connected bushings and studs. It conserves space in bus layouts. The blades have a pressure releasing device for easy opening. The high pressure contacts are of the silver-to-copper type. Rating of this disconnecting switch is 3000 amperes, 23 kv. Delta-Star Electric Company, 2400 Block Fulton St., Chicago, Ill.



DELTA-STAR DISCONNECTING SWITCH

NEW, ALL-PURPOSE MITCHELITE

*Simplest...most flexible answer to
every Fluorescent Lighting Need...*

MITCHELITE is making lighting history! This amazing new line of fluorescent fixtures is so simple and flexible...so rugged and efficient...so easy and economical to install and maintain...it completely answers today's industrial lighting problems!

FOUR BASIC MITCHELITE MODELS (illustrated) make it easy to solve every lighting situation in factory, office or drafting room. Each model can be used for both individual and continuous row lighting, for surface or suspension mounting. Wide range of MITCHELITE accessories and fittings provide for every method of mounting or hanging.

MITCHELITE units are cooler operating...have new type wireway channel...are lighter in weight*...have famous Lumenite non-metal reflectors with remarkably high reflection factor...meet all latest requirements of WPB and U. S. Bureau of Standards...are Underwriters' Laboratories and E. T. L. Fleur-o-lier Approved throughout.

Solve your fluorescent lighting problem now...with MITCHELITE, the world's finest industrial lighting fixture line!

*40-watt units contain less than 3 pounds of steel per fixture.
*100-watt units contain less than 4 pounds of steel per fixture.

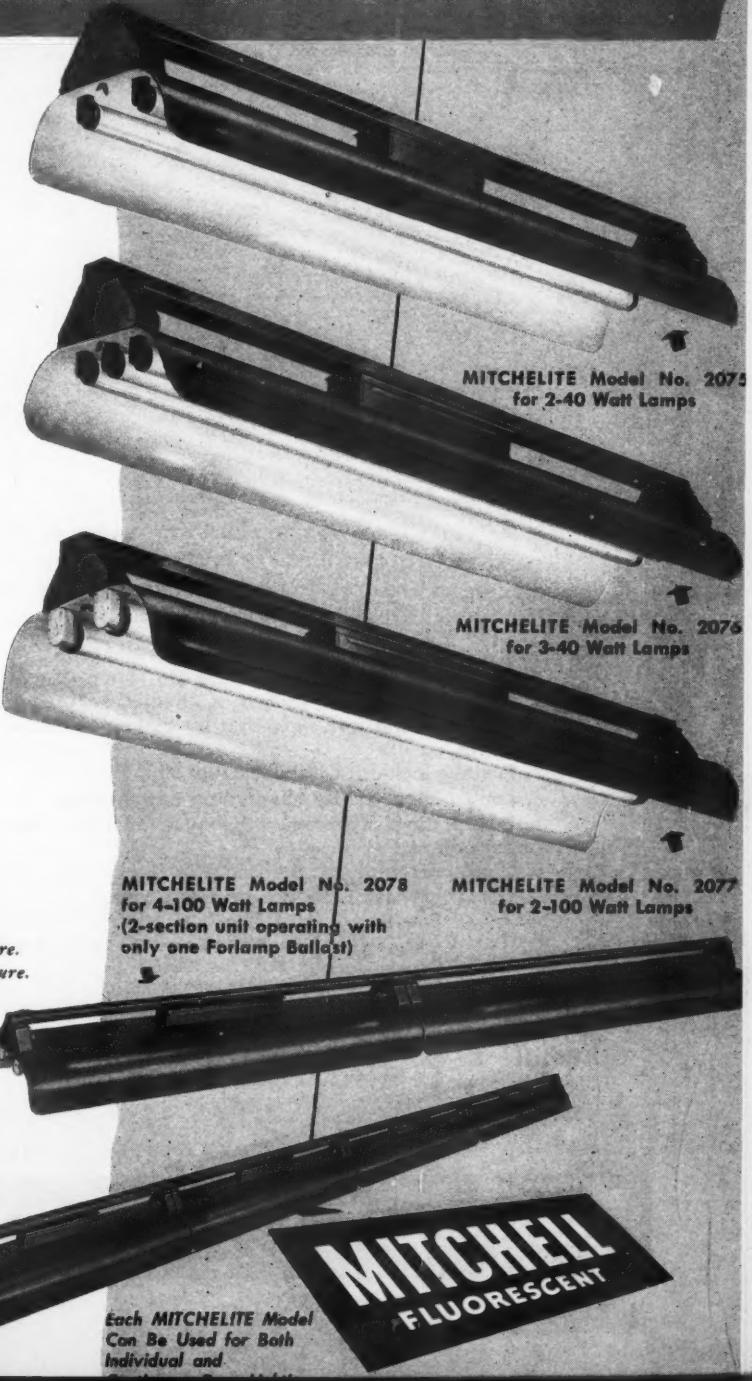
Get FREE Catalog No. 400

New illustrated MITCHELITE Catalog gives complete details...shows mounting methods. Get your free copy now from your MITCHELL DISTRIBUTOR, or write to

MITCHELL Manufacturing Company
2525 North Clybourn Ave. • Chicago, Ill.



These "Lightweight" Units
Comply with Latest
W. P. B. Requirements
Effective May 5th



Each MITCHELITE Model
Can Be Used for Both
Individual and

MITCHELL
FLUORESCENT



Once again, after long experimenting, General Electric contributes to better, more economical and more satisfactory fluorescent lighting. The new FS-40 "Watch Dog" has everything. Here are its major features:

1. Average life equivalent to the life of ten 40-watt lamps under specified test conditions.
2. Ends blinking and flickering by cutting out dead lamps.
3. Positive lock-out with all current off.
4. Long ballast life by eliminating current flow.
5. Instant lamp replacement because there's no cooling period.
6. Conserves vital war materials.
7. All of this means reduced costs to you.

SEND THE
COUPON FOR
COMPLETE
DETAILS

 * Section G632-8
 * Appliance & Merchandise Dept.
 * General Electric Co., Bridgeport, Conn.
 * Gentlemen: Please send additional information on your new
 * FS-40 Starter to:
 * Name.....
 * Company.....
 * Address.....
 * City..... State.....

GENERAL  **ELECTRIC**

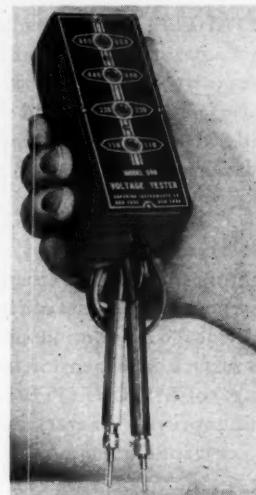
G-E DOES IT AGAIN!

EQUIPMENT News

[FROM PAGE 136]

Voltage Tester

This voltage tester reads like a thermometer. To use, connect the needle pointed test prods across any electric line and it automatically indicates what the voltage is; if current is a.c. or d.c.; if motor, appliance, etc. connected in the line is open; which leg is grounded; if frequency is 25 or 60 cycles; if fuse is blown; excessive leakage between a motor and a line. Tester measures 1½ by 5- by 18-inches. Superior Instruments Co., 227 Fulton Street, New York, N. Y.



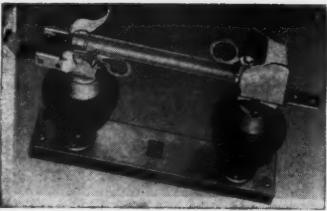
SUPERIOR VOLTAGE TESTER

Plug

The new Hopax circuit breaker plug provides protection for motors, power tools, fluorescent lighting units, etc. from over-load or short circuit. It automatically disconnects the faulty piece of equipment from its electric supply. The small red lever breaks the connection. The plug does not have to be renewed after the circuit has been broken. It is reset by raising and lowering the lever. The plug is actuated by heat, providing a time delay feature that prevents interruptions. On normal overloads, such as sudden surges, this time delay feature assures that current will be stopped only when conditions become dangerous. Hopax Industries, Inc., 1 North LaSalle St., Chicago, Ill.



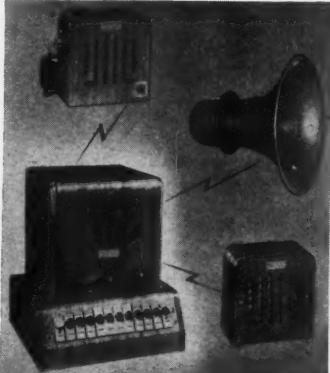
HOPAX PLUG



WESTINGHOUSE BORIC ACID FUSE

Fuses

For outdoor power systems a new weather-protected intermediate duty boric acid fuse, which interrupts the circuit to the faulted equipment, and isolates the fault from the feeders with a complete 180° air break is announced. In the new DBA-1 fuse the blown fuse unit is dropped out of the circuit after the fault current is interrupted. Other features are the "de-ion" boric acid arc quenching action and the sleetproof ejector mechanism for all-weather operation. It is available in voltage ratings from 7.5 kv. through 69 kv. It is applicable in utility and industrial high-voltage power systems for protecting power transformers, feeder-circuit sectionizing, distribution transformers, high voltage capacitors and potential transformers. Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa.



EXECUTONE COMMUNICATION SYSTEM

Communication System

This central control master station is now equipped with an annunciator selector having a buzzer and name tabs which illuminate to identify incoming calls. Built into a detachable base which can be replaced with larger-capacity selectors for future expansion, this new unit enables the user to talk individually up to eleven other remote stations in the system, or page them all simultaneously. Likewise any other station in the system can signal and register its call on the master station's annunciator selector. A manual buzzer, which sounds to signal that another station is calling, can be cut off during conversations by flipping a toggle switch. Executone, Inc., 415 Lexington Avenue, New York, N. Y.

P.M.*
insures against
ELECTRICAL
BREAK-DOWNS

* P.M. is for Preventive Maintenance, a term which aptly covers the periodic use of "MEGGER" Testers for checking the condition of insulation in generators, wiring, motors and other electrical equipment. Incipient insulation troubles are thereby detected and isolated... and corrective measures can be taken before major failures occur. As a consequence, damage or destruction of valuable equipment is prevented and priceless production time is saved. Preventive Maintenance is obviously more practical than permitting insulation to break down—and then hold a Post Mortem to determine the cause.

If you are already familiar with the "MEGGER" Testers and what they do, you most likely have one in your plant. Plan to use it systematically. It is your ounce of prevention against costly electrical breakdowns.

Do you have our Pocket Manual of "MEGGER" Practice?
If not, write for a free copy of Manual No. 1420-EC

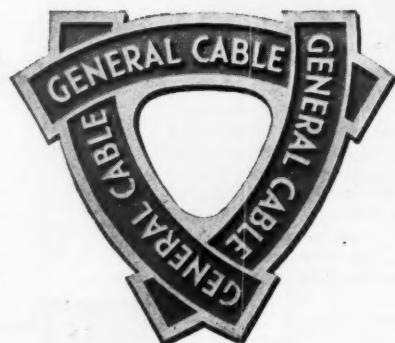
JAMES G. BIDDLE CO.
1211-13 ARCH ST. • PHILADELPHIA, PA.

"MEGGER"

Insulation Testers, Ground Testers and Ohmmeters

Our Contractor friends will recognize their participation, too, in the war-time conversion to essential activities of all our industry groups. In making the public conscious that industrial Electrical Maintenance is a vital war service, we hope to give the men so engaged the special recognition that is their due.

General Cable Corporation Sales Offices: Atlanta, Boston, Buffalo, Chicago, Cincinnati, Cleveland, Dallas, Detroit, Houston, Kansas City (Mo.), Los Angeles, New York, Philadelphia, Pittsburgh, Rome (N.Y.), St. Louis, San Francisco, Seattle, Washington (D.C.)



CIVILIAN SUPPLY SERGEANTS, THE U.S. FORGOT

TODAY'S NEWS, TUESDAY, MAY 25, 1943

WHOLESALE
ELECTRICAL

In spite of hell and high water they get it done

The Electrical Wholesaler...the
Institution that has filled War
Industries' Need and proved
itself a Lifesaver

JUST think what it would mean to an harassed purchasing department to have to
call out 200 manufacturers 50 miles,
different items. Some manufacturers 500 miles,
some 2,000 miles distant. Think of the paper
work in issuing hundreds of separate orders, of

the multiple salesmen to be seen, of the letters
to be written, of the long distance telephoning.
Purchasing would take twenty times the man
power, and fifty times the hours. It just couldn't
be done!

Fortunately for the war effort, industry
doesn't have to do it that way. The Electrical
Wholesaler is there to shoulder the burden and
show the world that the fabric of American busi-
ness is woven into a pattern that fits as truly
under war conditions as in days of peace. He

knows where to get materials, how to expedite
delivery, how to follow-up — how to function as
the all-necessary Civilian Supply Sergeant

and Trouble-Shooter extraordinary.
He has done it in places and ways which
have saved days and weeks in the launching of
ships and the shipping of supplies to our armies
and our allies. Well may America be proud of
the war-time resourcefulness and patriotic zeal
of the men who, unheralded, have kept electrical
supplies flowing.

GENERAL CABLE
CORPORATION



MANUFACTURERS OF
SHARPE AND INSULATED WIRES
AND CABLES FOR EVERY ELECTRICAL PURPOSE

* This advertisement appears in the May 25th issues of
The New York Times, Chicago Tribune, St. Louis Globe Democrat, San Francisco Examiner,
Washington Post, Philadelphia Inquirer, Los Angeles Examiner, Dallas News, Boston Herald
Traveler, Cleveland Plain Dealer, Detroit Free Press, Seattle Post Intelligencer, Buffalo Courier
Express, Pittsburgh Post Gazette, Kansas City Star—and in the May 29th issue of Business Week.



WPB ASKS SECOND FLUORESCENT INVENTORY

Manufacturers and distributors of fluorescent lighting fixtures are required by War Production Board to file a report showing inventories of complete fluorescent lighting fixtures manufactured before June 2, 1942, on hand as of May 28, 1943. This report must be filed on Form WPB-1066 which was mailed direct to all persons who filed Form PD-499 in June of 1942, and which is also available in WPB Field Offices.

In addition to reporting inventories of complete fluorescent lighting fixtures, space is provided on Form WPB-1066 for reporting fabricated parts for non-industrial type fluorescent lighting fixtures, which parts were manufactured before October 19, 1942.

Form WPB-1066 differs from the June 2, 1942 inventory form PD-499 in that the new form requires an inventory of all fluorescent lighting fixtures manufactured before June 2, 1942, whereas form PD-499 did not require holders of less than 25 complete fixtures to list their inventories.

This inventory information is desired so that purchasers holding a preference rating of B-2 or better as required by Limitation Order L-78 may be directed to such inventories for their non-industrial fluorescent lighting fixture requirements in order to secure quick delivery and in the interest of conservation of critical materials which would otherwise be used in the manufacture of new fixtures of similar types.

Instructions accompanying Form WPB-1066 are as follows:

1. Each manufacturer, assembler, wholesaler or retailer of fluorescent lighting fixtures who has in his stock, regardless of ownership, 40 watt or larger complete fluorescent lighting fixtures manufactured before June 2, 1942, and/or completely fabricated parts manufactured before October 19, 1942, shall furnish an inventory on this form showing quantities of such fixtures and/or parts which are in his stock.
2. This form shall be filled out and one copy mailed on or before May 31, 1943, to the War Production Board, Building Materials Division, Lighting and Fixtures Section, Ref. L-78, Washington, D. C.
3. Inventories may be combined on this report for all locations for those firms having inventories in more than one location.
4. "Complete Fluorescent Lighting Fix-

ture" means any new 40 watt or larger fluorescent lighting fixture which is for sale and was manufactured and assembled before June 2, 1942, complete with all component parts except fluorescent lamp or lamps so that it is ready for shipment and/or installation.

5. "Completely Fabricated Parts" means any component part of a non-industrial type fluorescent lighting fixture which was manufactured before October 19, 1942, and is ready for assembly into a non-industrial type of fluorescent lighting fixture.

NECA REPORTS MRO AMENDMENT

As the result of conferences between NECA and WPB, the CMP Regulation No. 5, Maintenance, Repairs and Operating Supplies, has been amended to provide that any person engaged in the business of doing maintenance or repair work for others, may use the same allotment symbol and preference rating to obtain materials needed in the performance of the work which his customer would be entitled to use if the customer did the work himself. This amendment will simplify the relations between the electrical contractor and his customer on maintenance or repair work.

NEWTON RECEIVES McGRAW AWARD

John M. Newton, president of the Oakes Electrical Supply Company, Holyoke, Mass., received the James H. McGraw Award Wholesalers Medal for 1942 at the spring meeting of the National Electrical Wholesalers Association in Buffalo, May 26. The presentation was made by S. B.

I List below May 28, 1943 stock of all complete fluorescent lighting fixtures (40 watt or larger) manufactured before June 2, 1942, for operation on 110-125 volt, 60 cycle alternating current.

TYPE	Quantity						
	1/40	2/40	3/40	4/40	1/100	2/100	Other*
Industrial **							
(Surface mounted shielded)							
(Surface mounted unshielded)							
(Pendant mounted shielded)							
(Pendant mounted unshielded)							
All Other							

*Describe _____

(Attach separate sheet if more space is required)

**Industrial includes all direct lighting type fixtures equipped with reflectors designed to control the light and to shield the tubes, suitable for the illumination of manufacturing areas.

II List below May 28, 1943 inventory of completely fabricated parts of non-industrial type fluorescent lighting fixtures manufactured before October 19, 1942, which parts are for assembly into 40 watt or larger non-industrial type fluorescent lighting fixtures.

	Chassis	End Plates	Liners	Stems	Canopies	Louvers	Other Parts*
2/40 Watt							
4/40 Watt							
All Other							

*Describe _____

(Attach separate sheet if more space is required)

III The undersigned certifies that the above information is complete and correct to the best of his knowledge and belief.

(Name of Company)

(Signature of Authorized Official)

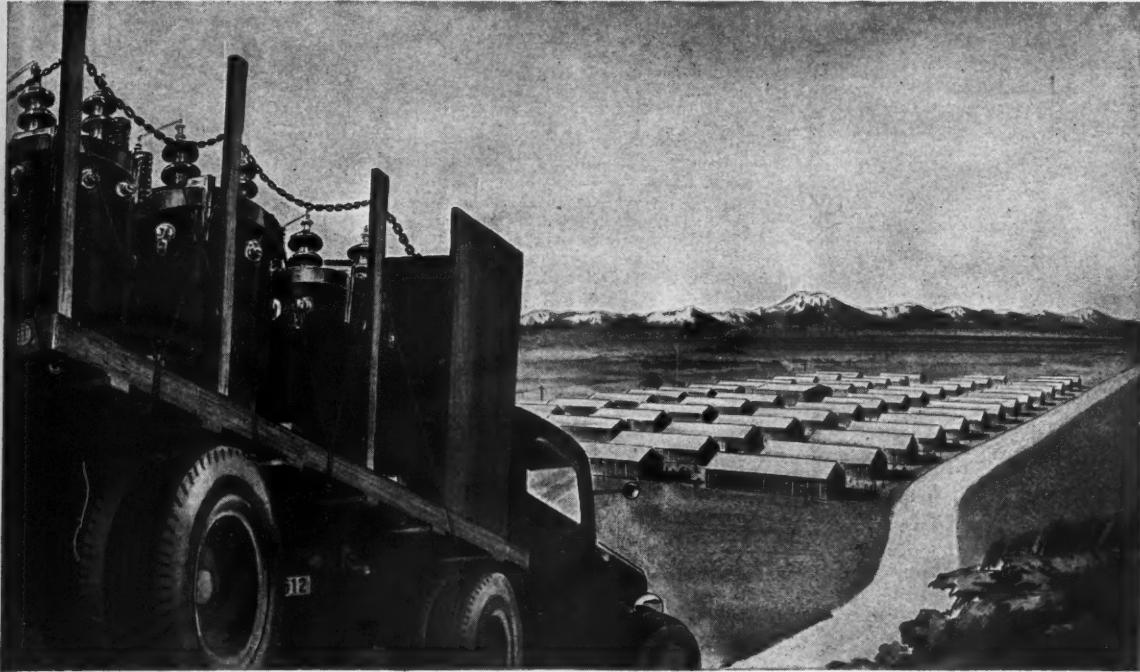
(Date)

(Title)

Section 35(a) of the United States Criminal Code, 18 U.S.C.A. 80, makes it a criminal offense to make a false statement or representation to any department or agency of the United States as to any matter within its jurisdiction.

FACSIMILE of fluorescent inventory form. Copies of WPB-1066 may be obtained from WPB field offices.

ONLY AN ELECTRICAL WHOLESALER COULD THUS SPEED WAR PRODUCTION



WESCO speeds "oasis" in desert

**5-Way Phone Call Rushes 3 Transformers
740 Miles in 24 Hours to Parched Camp**

4:45 P. M.—teletype from Army Camp in desert to Wesco House—"Rush immediately 3—15 KVA Transformers for water pumping system." 5 P. M.—phone call—"Transformers must reach the camp within 24 hours." Within a few minutes Wesco located three transformers of the proper size but not of the exact characteristics specified.

Wesco immediately set up a 5-way telephone conference including the Army camp, Army Engineers office, electrical contractor, transformer manufacturer, and Wesco. The conference approved the transformers for the job and the 400-mile freight shipment to Wesco started that night. Arriving early next morning the transformers were loaded on a truck for the remaining 340-mile race across the desert and were at the camp, 740 miles from "home", less than 24 hours after Wesco received the order.

Scores of other examples attest the quick thinking, initiative and speed Wesco applies to war problems. Come Victory, this service will again aid industry and business everywhere.

WESCO SPEEDS WAR PRODUCTION

- * A 3-story Army building covering 2½ acres was ordered to be built in 60 days. The local Wesco House provided 24-hour service, supplied 125 different electrical products made by 10 manufacturers.
- * Lack of two electrical items threatened to tie-up an important war plant. Best delivery by manufacturers was 8 to 15 weeks. Wesco had the materials on the job in 2 days!

WESCO SERVES BUSINESS

- * By providing trained sales and engineering personnel.
- * By supplementing manufacturers' advertising with own sales promotion efforts.
- * By providing engineering service in making up lists of materials and in preparing bids on jobs.

Westinghouse Electric Supply Co.

150 VARICK STREET • • • NEW YORK, N.Y.

A NATIONAL DISTRIBUTING ORGANIZATION WITH 80 BRANCHES



*The RIGHT
Replacement*

MOTOR-STARTING CAPACITOR

• Handy Aerovox listings of both the exact-duplicate and the so-called universal types, facilitate the selection of the RIGHT capacitor for any standard capacitor-start refrigerator motor.

Your local Aerovox jobber stocks both exact-duplicate and universal types for your convenience.

• Ask Our Jobber . . .

Ask for the latest Aerovox catalog listing motor-starting capacitors. Or write us direct.



In the News

[FROM PAGE 142]

Williams, editor of *Electrical World*, in behalf of the Committee of Awards. The citation reads:

"It has been said that circumstances make a man which is but another way of saying that in times of great emergency great personalities emerge to whom people instinctively turn for leadership. They generally are simple and forthright folk, imbued with an innate sense of right which gives them the courage to persevere when one of lesser faith would falter. Such a man is John M. Newton, president of the Oakes Electrical Supply Company of Holyoke, Massachusetts. When clouds of war in Europe began to threaten our national security, the electrical wholesaling industry turned to him for guidance by electing him chairman of the National Electrical Wholesalers Association. He may not have had a full realization of the great personal sacrifice in time and money that would attend his acceptance of the office but throughout his administration and afterwards he never let it deter him from the mission of helping his country to get from his industry the greatest possible benefit to the national defense and then the war effort. At a time when his business, an independent electrical wholesaling company, could least afford to share him he took upon his shoulders the great problem of his industry, namely the demonstration to those guiding our defense effort in Washington of the essentiality of electrical wholesalers. Under his direction the National Electrical Wholesalers Association assisted the government with personnel procurement and in the discussion which surrounded the drafting and issuing of priority orders and regulations. It was his tenacity, judgment, integrity, homespun



MEDALIST John M. Newton

philosophy and good humor more than any other one thing that was responsible for the opportunity given to the electrical wholesalers to take such an important part in the war effort. For this contribution to his country and to his industry, the judges have awarded to him the Wholesalers Medal and Purse for 1942, given under the James H. McGraw Award."

The judges who selected Mr. Newton for the Award were Walter J. Drury, Graybar Electric Co., New York; J. H. Fisher, Westinghouse Electric Supply Co., New York; L. E. Latham, E. B. Latham & Co., New York and L. M. Nichols, General Electric Supply Co., Bridgeport.

NEMA COMMITTEE REVIEWS LIGHTING MATERIAL ECONOMY

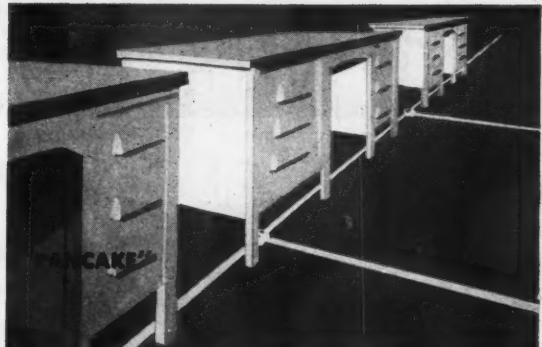
Each individual lighting source has distinctive characteristics which can be used in the conservation of critical materials, depending upon the structure itself, its use and occupancy, as well as upon the in-



"My Gaud, Gertie—a Man!"



ELIMINATE DANGEROUS MAINTENANCE...
COSTLY EXTENSION CORDS WITH PLUGMOLD



CARRY CURRENT FOR LIGHT, TELEPHONE OR POWER TO
OFFICE MACHINES AND PRODUCTION UNITS WITH "PANCAKE"

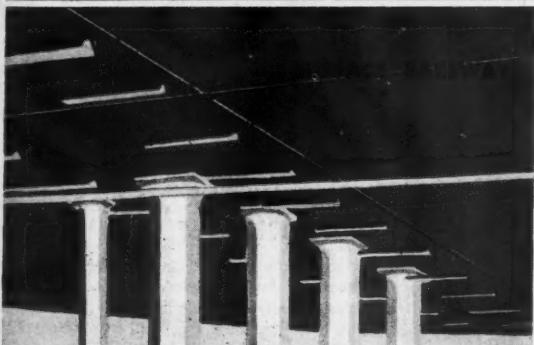
HOW WIREMOLD CAN HELP YOU

step UP efficiency...REDUCE maintenance in plant and office

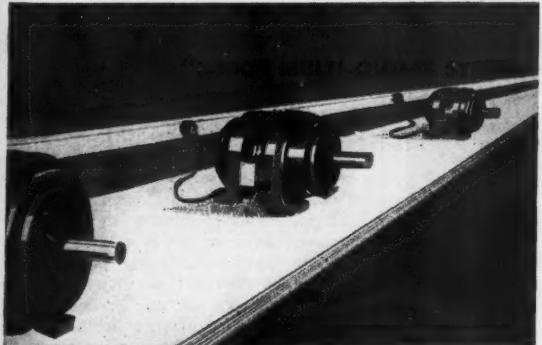
Wiremold literature . . . including engineering installation data sheets and our detailed Catalog Wiring Guide . . . is full of helpful ideas for electrical maintenance men. Sent free, of course. on request.

- Available on suitable priority, Wiremold Surface Metal Raceways conform to Federal Specification W-R-32. Listed by Underwriters' Laboratories.

The Wiremold Company Dept. EC-6, Hartford 10, Conn.



EXTEND OR RELOCATE WIRING FOR BETTER
LIGHT WITH WIREMOLD RACEWAYS AND FITTINGS



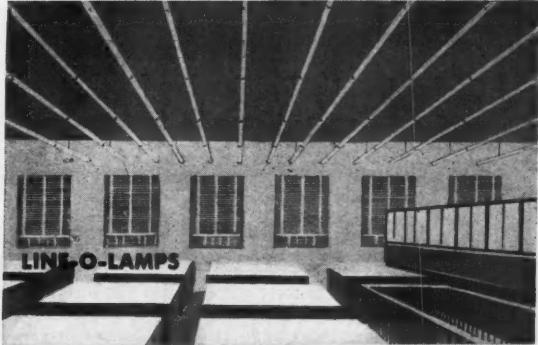
CONNECT TO NEWLY INSTALLED MACHINES QUICKLY AND EASILY
WITH WIREMOLD "3000" INDUSTRIAL MULTI-OUTLET SYSTEMS

3



USE SIMPLIFIED, EASILY INSTALLED WIREMOLD "3000"
WIRING SYSTEM FOR GROUPED BRANCH CIRCUIT FEEDERS

5



INSTALL HIGH-EFFICIENCY FLUORESCENT LIGHT
WITH SIMPLIFIED WIREMOLD LINE-O-LAMP SYSTEMS

6

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**TIME-SAVING FEATURES OF
J-M TRANSITE DUCTS -- NO. 1**

**SPEEDY
ASSEMBLY!**

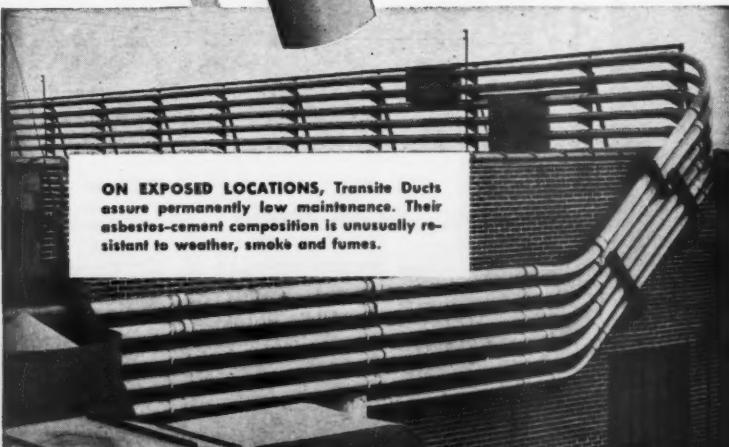
Harrington Couplings are installed cold . . . need no special skill to form tight joints . . . assure correct alignment. A complete line of bends, sweeps and special fittings is available.

There's no lost motion assembling Transite Ducts. Harrington Couplings eliminate screwing or threading . . . go together quickly . . . drive up tight.

Transite's smooth, slick bore means rapid cable pulls. Because Transite Ducts are light in weight, they are easily handled. And on the job, their asbestos-cement composition assures complete fire-safety, unusual resistance to corrosion.

For details, write for brochure DS-410. Johns-Manville, 22 East 40th Street, New York, N. Y.

ON EXPOSED LOCATIONS, Transite Ducts assure permanently low maintenance. Their asbestos-cement composition is unusually resistant to weather, smoke and fumes.



JM Johns-Manville
TRANSITE DUCTS

TRANSITE CONDUIT . . . for exposed work and for installation underground without concrete encasement.

TRANSITE KORDUCT . . . for installation in concrete. Thinner walled, lower priced, but otherwise identical with Transite Conduit.

In the News

[FROM PAGE 141]

genuity of the lighting engineer according to a report by the General Technical Committee of Industrial and Commercial Lighting Equipment Section, of NEMA.

The report stated that no one single light source or single lighting system satisfies all lighting problems of industry, nor do the amounts of critical materials involved indicate that a single type of light source can be universally applied with full consideration to the conservation of critical material.

The following sources were considered by measuring the weight of the various critical materials used in both the wiring systems and the proper approved equipment including such factors as efficiency, depreciation, power factor correction, etc.; two-lamp 40-watt fluorescent units, three-lamp 40-watt fluorescent units, installed singly and continuously end-to-end, two-lamp 100-watt fluorescent, four-lamp 100-watt, 400-watt mercury, steel and glass enclosed, 500 and 1000-watt incandescent with glass reflectors, 500 and 1000-watt incandescent with porcelain enamelled reflectors, as well as other combinations.

Each of these light sources when installed in proper equipment is a tool of the lighting engineer in providing adequate illumination for the difficult visual task of high war production with the use of a minimum amount of critical materials depending upon the ingenuity of the lighting engineer in taking advantage of controllable factors provided by the structure itself, its occupancy and the disposition of various components of any given system, it was stated.

ROCKY MOUNTAIN INSPECTORS MEET

Problems peculiar to the electrical contracting business were presented, discussed and at least partially solved at the Ninth Annual School for Electrical Inspectors, conducted in Denver under auspices of the Rocky Mountain Chapter, Western Section, International Association of Electrical Inspectors.

The event drew inspectors, contractors, electric utilities personnel, wholesalers and manufacturers' representatives from fourteen cities in five states—Colorado, Wyoming, South Dakota, Indiana and Illinois. Despite serious handicaps imposed by transportation restrictions, attendance was normal.

Victor H. Tousley, field engineer NFPA, Chicago, explained interim amendments to the code and disclosed that critical materials shortages had already been discovered by the electrical industry and emergency machinery set up for distribution long before government agencies entered the picture with plans for conservation and estimates of stock piles.

Tips on the availability of critical mate-

rials, and information on procedure to obtain them were given by Austin Dunham, district manager of the Anaconda Copper Company. He pointed out the need to specify individual conditions in applying for priorities; why certain materials cannot be obtained, and what proportion of actual needs are available.

Marion M. Wilson, retiring chairman of the Rocky Mountain Chapter, exemplified the importance of expert guidance in electrical matters by citing a \$2,000,000 loss suffered by a community whose industrialists and municipal officials rejected the services of a delegation of Inspectors.

Victor C. Moulton, president of the Western Section, IAEI, and secretary-treasurer of the Rocky Mountain Chapter announced that all members of the organization in the nation's armed services will be carried free of charge for the duration, and receive all literature and communications on request; he regretted that Code standards, built up by half a century of effort, are being torn down by war necessities, and urged that IAEI's objective be a return to pre-Pearl Harbor standards as rapidly as conditions will permit.

At conclusion of the two-day school, the Rocky Mountain Chapter elected new officials as follows: Charles B. Farrah, Denver, chairman; W. C. Quandt, Pueblo, first vice chairman; V. D. Markham, Colorado Springs, second vice chairman. V. C. Moulton, Denver, was re-elected secretary-treasurer. Marion M. Wilson, by virtue of his past chairmanship, became a member of the executive committee; Tom McKay, Colorado Springs, was elected to the committee, to replace V. D. Markham who became 2nd vice chairman.

GOPHER CONTRACTORS REVIEW WAR PROBLEMS

After better than a year of experience under wartime restrictions, more than 125 Minnesota electrical contractors met at the Hotel Nicollet, Minneapolis, to exchange ideas, seek solutions to immediate problems and discuss future and postwar possibilities. They assembled with more than 300 other electrical industry representatives at an Electrical War Conference, April 26-27, sponsored by 11 different organizations and coordinated through the North Central Electrical Industries group.

An all-inclusive program followed the pattern of individual sessions for each organization with several general meetings on current problems affecting all phases of the electrical industry.

The annual meeting of the Minnesota Electrical Association, composed of contractors and dealers outside of the Twin-Cities area, was the opening gun of the contractor activities. Floor discussions at the round table portion of the meeting centered around rural wiring problems and the service, maintenance and repair of farm electrical equipment. The necessity of carefully designing farm electrical systems to provide the greatest pos-

RE-LIGHTING

the new manpower production requirement

HERE'S ONE ANSWER

to this problem...



This new folder tells the whole story. Send for it!

Because most plants operating today were designed for peacetime, *daylight* working schedules, their lighting equipment is inadequate for night work!

The folder illustrated gives one answer to industry's problem of *re-lighting*. Silv-A-King's new fluorescent reflectors of non-critical, metal-saving Silv-A-Tex are durable, efficient, inexpensive, and available for prompt delivery. For complete descriptions and specifications of Silv-A-King "Victory" units, write for a copy of "Catalog 43-V" today!



BRIGHT LIGHT REFLECTOR COMPANY, INC.

1033 Metropolitan Avenue, Brooklyn, N. Y.

BROIL KING AFTER THE WAR, MORE THAN EVER
America's Finest Electric Table Broiler
INTERNATIONAL APPLIANCE CORPORATION
1027 Metropolitan Avenue, Brooklyn, N. Y.



In the News

[FROM PAGE 147]

sible productive capacity under the present 75 pound limitation on copper was stressed, as was the importance of thoroughly understanding priorities and price regulations affecting installations of new systems and extensions to existing ones.

At the business session the following officers were elected: president, Eric G. Nyland, Duluth; vice-president, Leo P. Kemp, Winona; secretary-treasurer, Wm. A. Ritt, St. Peter. Members chosen for the Executive Committee for 3-year terms include: Edw. Karst, Fergus Falls; Moreau Bailey, Albert Lea; Ole Hagen, Detroit Lakes; and L. E. Shaffer, Pipestone (retiring president). Directors to the Minnesota Electrical Council, from various sections of the state are: Southern—Wm. A. Ritt, St. Peter; Western—Sam Newstone, Montevideo; Central—John Ellenbecker, St. Cloud; Northwestern—Edw. J. Micka, Hibbing; and Northeastern—Wm. S. Johnson, Duluth.

The second contractor session was the annual meeting of the Minnesota Electrical Council which dealt primarily with contractor experiences in war plant work. Heading the program was Donald F. Kehne, president of the St. Paul Electrical Contractors Association and vice-president of the Council. Don related his experiences in doing electrical work in war plants and specifically emphasized the use of instrument surveys to assure the greatest possible utilization of the existing electrical system and equipment. August Eckel, Middle West Editor, *Electrical Contracting*, outlined the present trends in electrical system design in line with critical material conservation, the need for adequate maintenance and the ultimate post-war opportunities and reaction toward more adequacy, more safety protection, better workmanship and the return to pre-war standards of electrical construction. Speaking from a legal standpoint, D. M. Wakefield, Attorney for the Council, cautioned against casual reading of government regulations and haphazard analysis and interpretation thereto. A working knowledge of the regulations, a careful analysis and application to contractors' operations and an accurate set of records are essential, he warned.

Held as an integral part of the Conference was the annual meeting of the Minnesota Electrical Inspectors Association. The major portion of the meeting was devoted to reports from the field inspectors on farm wiring safety problems under wartime copper restrictions. A War Emergency Supplement to the 1940 Edition of the Minnesota Farmstead Wiring Regulations was presented for the inspectors' guidance on future farm wiring, effective for the duration of the critical material shortage. At the business session the following officers were chosen: president, Walter H. Hackett; vice-president, W. L. Wadsworth; secretary-treasurer, Glenn Rowell—all from Minneapolis. Those elected to the Board of Directors are:

PROTECTING ELECTRICAL APPARATUS FOR LONGER LIFE

There's a G-E Insulation for Every Need

These are only 5 of a complete line of insulation materials designed for service under all conditions. For detailed information, write to Section M633-8, Appliance and Merchandise Dept., General Electric Company, Bridgeport, Conn.

GENERAL ELECTRIC

H. U. Cooper, Waseca; T. W. Joesting, Owatonna; H. G. Fritz, Jackson; and Oscar Savig, St. Cloud.

Conference delegates found the answers to many of their perplexing priorities and price problems at a special session led by a panel of leading Twin-Cities experts in these respective fields. All industry-sessions on post-war planning dealt with such topics as electronics; germicidal lamps; power on the farm; freezing, brining and dehydration of foods; electric appliances and overloaded house wiring. Speakers on these subjects included T. E. Johntz, General Electric Company; George Payton, Westinghouse Lamp Division; Dean C. H. Bailey, Director Department of Agriculture, University of Minnesota; J. D. Winter, University Farm School; Paul McCracken, Economist, Federal Reserve Bank, Minneapolis; and A. E. Schanuel, National Adequate Wiring Bureau, New York.

NECA CONFERENCE IN CHICAGO

A conference of NECA members was held at the Palmer House in Chicago on June 6 to tackle the job of cooperative planning for new opportunities in war service.

Discussion of new fields of service in shipbuilding and industrial maintenance were under the direction of leading contractors and representatives of the Maritime Commission, Navy Department and WPB.

FRACTIONAL HP. MOTOR REPLACEMENT PLAN

The Fractional Horsepower Motor Industry Advisory Committee discussed in detail the special problem of motor servicing of essential appliances and recommended that adequate revolving stocks of standard motors of various types be maintained throughout the country for exchange replacement. From three to five thousand standard motors are needed, the committee stated, to replenish existing stocks and insure prompt replacement service. Under the plan recommended a burned out motor would be exchanged for a reconditioned one, and the old motor would be repaired and put in the replacement pool for further service. Standard fractional motors are used on essential appliances, including washing machines, pumps, domestic refrigerators, and coal stokers.

STANDARDIZATION OF SMALL INSTRUMENTS

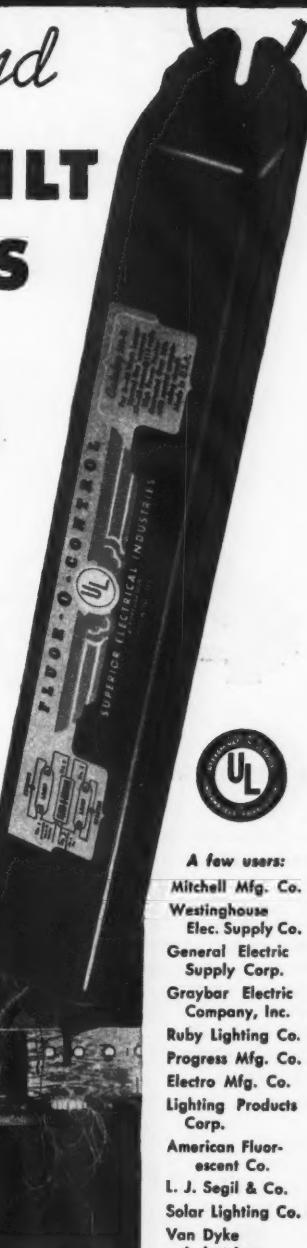
Many small electrical instruments used in radio and radar, such as voltmeters and ammeters, can be reduced by standardization from sixty varieties to one or two, according to the Electrical Indicating In-

FOR LONGER LAMP LIFE and INCREASED LIGHT OUTPUT*

CUSTOM and Precision BUILT BALLASTS



Superior Custom and Precision Built Ballasts for stock items are giving users approximately 25% additional lamp life and increased light output by retarding the blackening of the lamp ends. The successful operation of Superior Ballasts is due to exclusive patented features developed to overcome the common faults of competitive ballasts of similar design. The entire ballast-manufacturing process is under one roof—in Superior's new Chicago plant...and there is a Superior Ballast to fit every type of fluorescent unit.



A few users:

Mitchell Mfg. Co.
Westinghouse
Elec. Supply Co.
General Electric
Supply Corp.
Graybar Electric
Company, Inc.
Ruby Lighting Co.
Progress Mfg. Co.
Electro Mfg. Co.
Lighting Products
Corp.
American Fluorescent Co.
L. J. Segil & Co.
Solar Lighting Co.
Van Dyke
Industries



WRITE FOR NEW DESCRIPTIVE CIRCULAR

SUPERIOR ELECTRICAL INDUSTRIES
FLUOR-O-CONTROL, QUALITY CONDENSERS, ELECTRICAL TRANSFORMERS AND SOLENOID WINDINGS OF ALL TYPES
DEPT. A — 2614 W. NORTH AVE., CHICAGO, ILLINOIS

TO HELP THE ELECTRICIAN GET MORE WORK DONE!



A BENDER FOR ANY JOB

• There's a Greenlee Bender for any of your bending jobs. Small hand benders and powerful hydraulic benders for conduit, pipe, and tubing from $\frac{1}{4}$ to $4\frac{1}{2}$ -inch size. Greenlee Hydraulic Benders are easily operated by one man... save the cost of many manufactured bends and fittings... are compactly built in one unit... and are easily carried to the job and set up. The No. 770 Bender, shown here, will bend $1\frac{1}{4}$ to 3-inch pipe while the No. 775 Bender will handle 3 to $4\frac{1}{2}$ -inch material.



PULL CABLE EASIER AND FASTER

• The Greenlee Cable Puller will save many hours of work when pulling in cable. This handy tool clamps right on to the conduit through which cable is pulled... is easily carried to the job... can be set up in a jiffy... and is easy for one man to operate with one or two hand cranks. This cable puller, with a maximum pull of 7500 pounds and with two speeds, can be clamped to 2 to 5-inch conduit.

ENLARGE HOLES without drilling, reaming or filing

• Greenlee Knockout Punches and Cutters will enlarge holes in metal up to $\frac{1}{8}$ -inch thick without long tedious drilling and filing. A Knockout Cutter or Punch is inserted in a knockout or a small drilled hole, a few turns of the drive nut with an ordinary wrench, and a hole up to $3\frac{1}{2}$ inches can be cut in $1\frac{1}{2}$ minutes or less.



SEND FOR GREENLEE CATALOG 33-E



• Write for free copy of this valuable reference and buying guide to the complete line of Greenlee Tools for the Electrical worker.

GREENLEE TOOL CO.

1746 COLUMBIA AVENUE • ROCKFORD, ILL.

In the News

[FROM PAGE 149]

strument Industry Advisory Committee.

The adoption of American War Standards will facilitate the production of instruments, many of which will become interchangeable. It also will simplify depot stocking and replacements.

It was said that simplification should not include the elimination of special scale markings, because switchboard and portable instruments are produced in small numbers and special scale markings do not disrupt the routines of manufacture. Such markings are functional rather than decorative.

L-221 AMENDED

A number of changes have been made in the provisions controlling production and delivery of electric motors and generators by General Limitation Order L-221 as amended by WPB.

Among the changes made are the following:

The definition of electric generators covered by the order is changed to exclude certain high-powered generators now controlled by WPB's Power Division.

Operating spares are excluded from the restrictions on idle equipment but such spares are limited to the amount specified in the order that any one person can hold and still be permitted to purchase new motors.

Reference is made to the services performed by the Used Equipment Section in assisting purchasers to locate used motors or generators.

Restrictions on the types and designs of motors and generators that may be manufactured and delivered are changed in minor respects.

The certification submitted by the dealer is simplified and the standard form adopted is attached to the order in Appendix A.

Purchases of motors by the Maritime Commission for use on shipboard are exempted from the order. Under the previous version of the order only purchases of above deck motors were exempted.

Coincident with the publication of the amended order, the War Production Board issued Interpretation No. 1 of L-221 classifying floating dry-docks as vessels. Under the terms of the order, electric motors and generators for use on any vessel are exempted from the limitations and restrictions imposed.

ARROWHEAD ELECTRIC AWARDED ARMY-Navy "E"

The Arrowhead Electric Company, enterprising Duluth, Minn., electrical contracting firm has the distinction of being one of the first electrical contractors to

Electrical Contracting, June 1943

be awarded the coveted Army-Navy "E" pennant for excellence in production. This signal honor culminated more than a year of ship wiring activities for W. S. Johnson, owner and manager of the firm.

Founded in 1934 with three employees, Arrowhead Electric steadily expanded until at present it has 91 men and women in the organization. When a shipbuilding boom hit the Duluth-Superior area, Bill Johnson began wiring several of the shipyards engaged in building coast guard patrol vessels and sub-chasers. He took a crack at wiring the ships themselves and did such an outstanding job that government officials felt suitable recognition should be given the firm.

The award was made at impressive ceremonies at the Shrine Auditorium, Duluth, on April 28. In presenting the award, Commander A. Lawton Ford, U. S. Coast Guard, Captain of the Duluth-Superior Port, noted that the Army-Navy "E" award stands not only for "excellence" in production, but for "expectation" of even greater achievement in the future. He also commented, "The high quality of the electrical installations made by the Arrowhead Electric Company have stood the test of battle, time and time again." In accepting the award W. S. Johnson expressed the appreciation of his organization and promised, ". . . we will continue to do our utmost to preserve the faith you have in us." The pennant was then turned over to Edna Larson, head of the office staff, E. R. Sawyer, superintendent of construction and Gordon Adams of the engineering staff. Edward Owen accepted the "E" pins for the employees which were presented by Major John Buxton, Fort Snelling, after he had read the citation.

Three previous Army-Navy "E" awards were made to Duluth shipbuilding firms.

FARMERS TO GET MAINTENANCE SUPPLIES

The Farm Machinery and Equipment Suppliers Committee of WPB has offered its assistance in alleviating the squeeze on repair and installation parts. The committee is well aware of the importance of a readily available supply of such supplementary equipment as small motors, wires, fittings, connectors, etc. needed for the installation and repair of farm equipment.

The installation and repair of milking machinery, farm water systems, conveyors, electric fences, etc. must not be held up in the delay of securing necessary supplementary supplies, if the farmer is to meet the food production goals set for him.

The Electric Fence Controller Committee has pointed out that an appreciable saving in labor and material has been effected by the use of electric fences on farms. Electric fences require less labor for building maintenance than ordinary farm fences and use only one strand of wire instead of three or four.

It was suggested that 1943-44 quotas for the manufacture of electric fence con-

THE ONLY 3000-HOUR GUARANTEED FLUORESCENT LAMP

Rated 5000 to 6000 hours.

NO STARTER SWITCHES

Artkraft resonant starting eliminates this trouble-maker.

CONSTANT-TEMP HOT CATHODE

Corrugated mesh ribbon filament holds abundance of emissive compound. Control of primary voltages prevents rapid discharge.

CONSTANT VOLTAGE POWER PACK

plus
these
additional
features



ARTKRAFT
Hot Cathode Fluorescent
Lighting Systems are now available
through the manufacturing and distributing facilities of:

EDWIN F. GUTH COMPANY
F. W. WAKEFIELD BRASS CO.
FOSTORIA PRERESSED STEEL CRP.

These companies will merchandise the Artkraft Systems under the name of Guth-Artkraft Fixtures, Wakefield-Artkraft Fixtures, and Fostoria-Artkraft Fixtures.

Artkraft licenses with other fixture manufacturers also will be announced soon. Those who have not as yet investigated the Artkraft license proposition are urged to do so immediately.

Write for Circular F 102.

WHOLESALERS:
Write for our proposition.

Gives efficient operation at 85 to 135 volts. Can also be used on 220- and 440-volt systems, single or three-phase. Cannot short circuit the line.

Artkraft's exclusive cathode design reduces blackening or darkening in the light column, resulting in a brighter, cleaner lamp.

100% POWER FACTOR at rated voltage.

98% or over within 85- to 135-volt range.

"Easy Mount" luminaire allows instant removal without tools, for cleaning non-ferrous reflector or lamps.

Stroboscopic (Flickering) Effect Reduced.

More light for the same current. Moderate first cost. Radically reduced maintenance cost.

Lamp replacements are less frequent, starter replacements eliminated, ballast replacements unknown, man-hours saved by making these replacements unnecessary.

Field Tested Under Adverse Conditions for Over Five Years.

FIXTURE MANUFACTURERS: Write for details on fixture manufacturing license.

ARTKRAFT
HOT CATHODE FLUORESCENT LIGHTING DIVISION
THE ARTKRAFT SIGN CO.

1113 E. Kirby St.

Lima, Ohio, U. S. A.

*Reg. U. S.
Pat. Off.

LONG LIFE



DEPENDABILITY



You buy small BUSHINGS instead of BOXES —for any change

Yes, you can change from Thick-Wall to Thin-Wall conduit—or from a Threadless to a Threaded connection—at any outlet of any Kondu fitting.

Just slip out one bushing and slip in another—it's that simple!

Think of the savings you make in time...in money invested in conduit fittings, and stockroom expense.

And every Kondu box is a union. You can change fittings without disturbing conduit—or can install a conduit line before the fittings are delivered.

Quickest to Install. Kondu holds permanently rigid and tight...self locking, vibration-proof. Practically unbreakable...100% re-usable. Write for Catalog.

KONDU CORPORATION,
Erie, Pa.



In the News

[FROM PAGE 151]

trollers be based on weight rather than units, as this will encourage the industry to increase the number of items produced from the allotted material. It was pointed out that weight quotas will stimulate simplification and substitution practices which will contribute to the conservation of steel in addition to giving the farmers more supplies.

MPR-251 INTERPRETATION

Applicability—where servicing and serviced companies are owned by the same person. A company which renders "construction or maintenance services" to another company is subject to the provisions of the regulation, even though both companies are owned by the same persons or stockholders.

Price determination—branch offices. Where a seller has several operating units or branches, each unit or branch is a separate seller, unless a uniform pricing system has been maintained for all units or branches.

SAFETY EQUIPMENT

Restrictions on the use of certain critical materials in the manufacture of safety equipment are eased by General Limitation Order L-114 as amended by WPA.

The order as amended February 15, 1943, limited the use of copper and copper-base alloys, synthetic plastics, aluminum, nickel, rubber, elastic fabric and other critical materials to the extent specified in Appendix A attached to the order.

Changes in L-114 as amended now and reasons for them are:

1. The use of aluminum in machine guards is permitted where any less scarce material is not practicable. Its use is held to be necessary to prevent damage to knives resulting from contact with harder metals; the estimated amount of aluminum needed for this purpose is not more than 1,000 pounds per year.

2. Copper or copper base alloys (other than nickel silver) may be used for eyelets having a diameter of 1/16 inch or less where steel eyelets cannot be used. Eyelets in these sizes, it has been found, cannot be manufactured economically in steel.

3. The period during which nickel plating may be used for spectacle type goggles has been extended from May 31 to November 30, 1943. No practicable substitute for nickel plating has as yet been developed for this purpose and the time extension is designed to permit continued search.

EVERY PHASE of electrical maintenance and repair work covered in this library



5 volumes of practical
how-to-do-it information

Every man concerned with the care and repair of electrical machinery should have these practical books, with their helpful tables, diagrams, data, methods and kinks. Every one of the five volumes is jammed to the covers with sound, how-to-do-it information—the kind you have to have when anything goes wrong. Liberal use has been made of practical data and practice in repair shops so as to combine the good features of a library of methods with handbook information covering these methods.

Electrical Maintenance and Repair Library

2042 pages, 1721 illustrations
and diagrams

These books show you how to

- install all types of motor and generator units;
- locate breaks in armature windings and do a workmanlike job of rewinding;
- know just what is wrong with an electrical machine and take charge of installation and maintenance work;
- make accurate tests of switchboards and apparatus and correctly balance the power with the load;
- handle every sort of wiring job;
- show competence whether it be in the use of a Stillson wrench or a Wheatstone bridge.

Includes trouble-shooting book

Now, in addition to four well-known practical books on all details of testing, connecting, rewinding, installing and maintaining electrical machinery, the Library includes Stafford's *Troubles of Electrical Equipment*, a book giving helpful maintenance information, special trouble-shooting charts, explanation of symptoms and causes of machinery trouble, specific remedies, etc. This revised library gives you the ability to handle bigger jobs with surety of results.

10 days' examination
Easy monthly payments

We want you to examine this Library for 10 days. If you don't want them at the end of that time, there's no obligation to keep them. On the other hand, if you decide you want the help these books can give you, sign the small monthly payment terms, and in a short time the books are yours, right while you have been using them. Send the coupon today.

EXAMINATION COUPON

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Send me Electrical Maintenance and Repair Library, 5 volumes, for 10 days' examination. If I find the books satisfactory, I will send you \$1.00 in 10 days, and \$2.00 a month until \$15.00 has been paid. Otherwise I will return the books postpaid.

Signature

Address

City and State

Firm or Employer

Position

EC. 6-43

4. Nickel plating may be used for specified parts of oxygen breathing apparatus, inhalators and hose masks to the extent necessary for effective functioning: No substitute type of plating has been found for these parts.

5. The use of synthetic plastics is permitted in goggle headbands, in addition to the nine items previously listed in Appendix A, since a non-critical plastic headband with some elasticity has been developed recently.

6. Elastic up to 21 inches in length may be used in headbands for cup type goggles. There are large stockpiles of suitable elastic fabric on hand which should be utilized this year before the rubber deteriorates.

WELDING ELECTRODES BECOMING AVAILABLE

Production of shielded arc electrodes, which has been far below essential requirements during the past year and a half, is increasing steadily and is now slightly in excess of current consumption needs. March production totaled 96 million pounds, valued at approximately \$10,000,000, as compared with 30 million pounds in January, 1942, and 88 million pounds in January, 1943.

Peak requirements for arc electrodes, essential in the production of ships, combat tanks, munitions and other vital war items, are estimated at 95 million pounds per month. It is expected that production will continue to increase until June, when a peak production of 110 million pounds, with a dollar value of \$100,000 per million pounds, is scheduled to be reached. Plant expansion will be completed and facilities will be fully utilized by that time.

As the ratio of production to consumption becomes more favorable, inventories that have been depleted during the long period of scarcity will be built up. Because of the essential nature of electrodes in war production, steps have been taken by WPB to control distribution and to prevent a few large users from getting overlarge inventories with resultant scarcity elsewhere.

Now that production is adequate, the Division stated, no essential war production need be delayed for lack of arc electrodes, if the distribution of inventory supplies is properly directed.

PRICE CEILING RAISED ON RC CABLE

Producers of rubber-covered wire and cable are permitted to quote higher than ceiling prices to reflect cost increases resulting from an authorized price increase for crude rubber.

The action does not permit the producers of the wire and cable to collect prices which are in excess of ceilings at the time of delivery. The adjustable pricing provision was incorporated in Amendment

Installation Goes Like Clockwork

... when you specify
"Skilled Lighting"
Fixtures by Wheeler!



RLM Incandescent Units

Wheeler One-Piece Solid Neck Reflectors made in Dome, Angle and all other standard types. Recommended for either indoor or outdoor use. Expertly designed . . . skillfully, ruggedly constructed



**RLM "War-Aid"
Fluorescent Units**

Temporarily replace standard Wheeler Fluorescent line. Fixtures are furnished with non-metallic reflectors and comply with WPB regulations limiting the amount of metal used in construction of wiring channel. Made for two or three 4" lamps, two 60" lamps.



You can avoid time-wasting troubles on your lighting jobs by selecting quality fixtures . . . equipment designed and built with the skill and integrity that come only through long years of specialized manufacturing experience.

Wheeler Fixtures are "skilled lighting" that will never let you down! They're made by lighting specialists with over 60 years' experience . . . designed for speedy, trouble-free installation . . . engineered for maximum lighting efficiency . . . accurately and sturdily constructed

to meet top standards of materials and workmanship. They'll help you get prompt inspector-approval on your jobs . . . save you later servicing.

All your requirements can be supplied by Wheeler's complete line of Industrial Fixtures. Wheeler engineers will be glad to work with you in planning the right layouts. Write for latest catalogs of Wheeler Incandescent and Fluorescent Fixtures. Wheeler Reflector Company, 275 Congress St., Boston, Mass. Branch offices in New York City and Cleveland, Ohio. Representatives in principal cities.

Distributed Exclusively Through Electrical Wholesalers

Wheeler REFLECTOR COMPANY
Lighting Equipment Specialists Since 1881

Why dig through a PILE of Catalogs?



Find the Fitting you need—quickly—in the COMPLETE line.

If you have a Penn-Union Catalog, you can instantly find practically every good type of conductor fitting. These few can only suggest the variety:



Universal Clamps to take a large range of conductor sizes, with 1, 2, 3, 4 or more bolts.

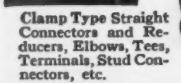
L-M Elbows, with compression units giving a dependable grip on both conductors. Also Straight Connectors and Tees with same contact units.



Bus Bar Clamps for installation without drilling on bus. Single and multiple. Also bus supports — various types.



Bus Bar Clamps for installation without drilling on bus. Single and multiple. Also bus supports — various types.



Clamp Type Straight Connectors and Reducers, Elbows, Tees, Terminals, Stud Connectors, etc.



Jack-Knife connectors for simple and easy disconnection of motor leads, etc. Spring action — self locking.

Vi-Tite Terminals for quick installation and easy taping. Also sleeve type terminals, screw type, shrink fit, etc. etc.

Splicing Sleeves, Figure 8 and Oval, seamless tubing—also split tinned sleeves. High conductivity copper; close dimensions.

Preferred by utilities, industries, electrical manufacturers, contractors — because they have found that "Penn-Union" on a fitting is their best guarantee of Dependability.

PENN-UNION ELECTRIC CORPORATION ERIE, PA. Sold by Leading Jobbers

PENN-UNION
Conductor Fittings

In the News

[FROM PAGE 153]

No. 3 to Revised Price Schedule No. 82 (Wire, Cable and Cable Accessories).

Price increases were authorized April 1, for crude rubber going into commodities sold for government use. The effect of this increase on the cost of producing wire and cable is being studied now by OPA.

Despite their quoted prices, producers will be held to ceilings which are in effect at the time of delivery, which may be lower than the prices they have quoted. The action merely allows producers to quote prices and accept orders at prices reflecting the increased price for crude rubber contained in their products without violating the schedule.

Present production is not affected by the action since producers are able to purchase crude rubber at the ceilings which existed before April 1 until May 31.

K.C.E.A. CAMPAIGNS FOR SCRAP METALS

The Electric Association of Kansas City, at the request of the local WPB office, is sponsoring an all-out metal scrap campaign. Primary goal is to get all scrap metals, particularly copper, which are not salable in their present condition from electrical dealers, distributors, manufacturers, utilities, contractors and appliance service shops.

As the scrap is collected it is deposited at various fire stations throughout the city where the firemen donate their time and effort to separating and sorting out the various types of metals. Money obtained from the sale of this scrap will go into the Firemen's Pension Fund thus giving the donators the dual satisfaction of helping the war effort and their own fire fighting organization.

In a similar campaign, the Electrical Dealers of Atchison, Kansas, gathered 300 tons of scrap metal. The K. C. group is using this figure to pace their drive and hopes to secure several times this amount in the next few months.

PORTABLE LAMP PRODUCTION RESUMED

Portable electric lamps may be produced from parts which had been wholly or partially fabricated by December 10, 1942, and such production may continue until July 15 according to Limitation Order L-33 as amended. After that date production again will be prohibited except for orders of Army, Navy, Maritime Commission, and War Shipping Administration.

Under Order L-33 as amended, restrictions of Copper Conservation Order M-9-c do not apply to specified parts that were

TIME SWITCHES

**TRIPLE POLE
DOUBLE POLE
SINGLE POLE**

All three types can be furnished with capacities ranging from 20 TO 200 AMPERES PER POLE, listing from \$16.50 up. Ten ampere Time Switches from \$3.95 up.

PROCESS TIMERS

INTERVAL TIMERS, or PROCESS TIMERS, are furnished in two types. One is reset by hand (manual); other resets itself, automatically. Both types can be provided for practically any cycle of time, fully adjustable from zero to maximum period. SYNCHRONOUS, SELF-STARTING MOTORS.

SIGNAL TIMERS

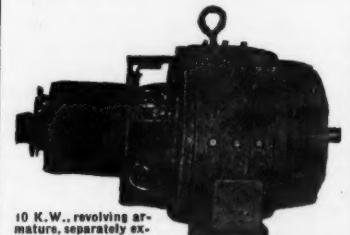
Used extensively for starting and stopping industrial work; school class periods; for municipal time signals, etc. Up to six signal periods, permanently set at factory with Sunday & Holiday Cutout and Manual Control, at a list price of only \$35.

Write for Information

AUTOMATIC ELECTRIC MFG. CO.

MANKATO, MINNESOTA

110-VOLTS A. C.
ANYTIME, ANYWHERE WITH
KATOLIGHT
GENERATORS AND POWER PLANTS



10 K.W., revolving armature, separately excited A.C. generator.

Furnish same kind of current as city power lines for operating standard A.C. portable electric tools, transmitters, receivers, floodlights, etc.

Good deliveries on A.C. generators, 350 through 15,000 watts. Available in all standard voltages 110, 220, single phase, 2 or 3 wire, three phase or three phase four wire. Frequencies 25, 30 or 50 cycle on specification.

Kato's entire production at present must be confined to orders with high priorities.

Also manufacturers of a complete line of rotary converters

KATO ENGINEERING CO.
530 Front St.
Mankato, Minn.

in a manufacturer's or his supplier's inventory on December 10, 1942.

Temporary allowances also are made for renewed production of shades. Beginning today and until July 15, a manufacturer may use silk which was in his inventory on March 23, 1942. Iron and steel in the form of wire or wire frames, and phenolic plastics, which were in his own or his supplier's inventory on December 10, 1942, also may be used.

Under L-33, portable electric lamp production was stopped, except for military orders, on December 10, 1942. The stop date for shades, under the same order, was January 1 of this year.

The order has resulted in an annual saving of more than 1,000 tons of copper and almost 1,000 tons of rubber from electric wire alone. In addition, there have been considerable savings in iron, steel, zinc, aluminum, bronze, and brass, previously used in bases and fixtures.

L-33 as amended is expected to provide relief for many manufacturers who had filed appeals with the Consumers Durable Goods Division and the Copper Division for permission to assemble prefabricated parts into lamps and shades.

USED MOTOR UNIT PROVES HELPFUL

The Used Motor Unit was able to fill all but 87 of the 1,515 requests for used motors and generators received in March, its first full month of operation.

Established within the Electrical Equipment Branch in mid-February to assist in locating idle second-hand motors and generators, the unit already has on hand a listing of from 30,000 to 35,000 pieces of idle equipment from which to fill requests. Though much idle equipment is still unlisted and the Unit is urging owners of such equipment to register it, requirements for general purpose standard types of second hand motors and generators can readily be filled.

March demands made through the Unit totaled 31,623 hp, and came from industry at large and from 29 war



REPAIR, maintenance and replacement parts of electrical equipment is the field John J. Wack, Wack Electric Co., Council Bluffs, Iowa, has chosen for the duration. Construction work is light in his area.

OVERWORKED MOTORS DESERVE DELTABESTON



THE battle cry of war industries today is production, more production and still more production. Keeping in step with fantastic war schedules means continuous operation...with no time to cool off overworked motors. This condition is serious because motors build up intense heat; wiring insulation bakes out; and machinery stops operating.

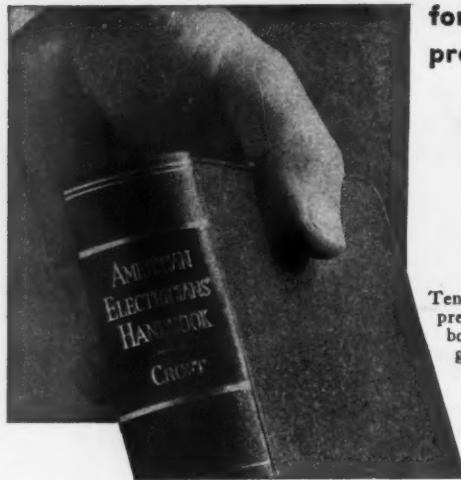
You can eliminate frequent motor failures by specifying Delta-Beston Magnet Wires when your motors are sent out to the repair service shop for rewiring. You'll find that when they come back, they'll stay on the job longer and perform with the utmost dependability even in high ambient temperatures. If you buy ready-made coils with class B insulation, ask for Delta-Beston-wound coils.

Delta-Beston Magnet Wires are available in round, square and rectangular shapes. Delta-Beston is insulated with asbestos purified by an exclusive process. The purified asbestos is "felted" to the flexible copper by a patented method which produces an extremely tight bond. The felted asbestos is impregnated with a wax compound to make it highly resistant to heat, moisture and corrosive vapors.

Here's the answer where heat endangers—it's yours for the asking. Write to Section Y635-8, Appliance & Merchandise Dept., General Electric Co., Bridgeport, Conn. G-E Delta-Beston Magnet Wires are distributed nationally by Graybar Electric Co., G-E Supply Corp. and other G-E Merchandise Distributors.

GENERAL ELECTRIC

Get the right answer fast . . .



for more efficient
profitable handling of

every type of practical electrical job

Tens of thousands of men have used previous editions of this famous handbook with satisfaction, as a working guide of everyday usefulness. Now it is ready to help you too, in a big fifth edition—600 pages larger than before—brought up to date in every respect—more than ever before the one great pocketbook of practical electricity for you

5th Edition—Croft's

AMERICAN ELECTRICIANS' HANDBOOK

This book is packed from cover to cover with the facts which every man engaged in electrical work needs to have constantly at hand. It gives the information you need in the form in which you can use it. From clear explanation of the fundamentals of electricity to suggestions for remedying the troubles of electrical equipment, the information is the kind that helps practical electrical men—wirers, contractors, linemen, plant superintendents, operators, construction engineers, and others—to select and install commercial electrical apparatus and materials intelligently for the performance of specific services. It gives the kind of data that will help them operate electrical equipment efficiently and to maintain it at high operating efficiency.

10 big detailed sections give you such materials as:

- most complete data and information on all commonly employed electric wires and cables ever assembled in one volume, to help in selection of proper type for any installation, methods of handling, splicing, etc.
- simple instructions for calculating load on circuits, and for selecting proper wire size to meet voltage drop and current carrying capacity conditions.
- entirely new division to aid in selection and specification of switching, protective, capacitor, and wiring-device equipment, estimation of space requirements for switchboards, care and operation of batteries, etc.
- practical data on operation, care, installation, and selection of motors and control equipment, including information on planning of motor circuits and drives.
- helps on installation, care, and proper loading of transformers
- practical information on construction methods and materials in outside distribution
- details of all types of interior wiring; developments in light fixtures and luminaire equipment; etc.
- new section of 64 handy wiring tables, conveniently arranged

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1600 pages of

practical data, helpful pointers, explanatory illustrations and diagrams, useful rules, recommendations, and short cuts, and much descriptive information on modern electrical practice. 327½, 1177 illustrations, price only

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- Accurate data and engineering principles presented in simple, understandable language.
- Many worked-out problems to illustrate application of rules
- All information in accordance with 1940 National Electrical Code and preferred present-day practice

Hundreds of facts condensed and classified for quick, easy use—Use this Handbook to check your methods for quick answers to troublesome problems, as a dependable reference and study guide of electrical fundamentals, equipment and materials, and their application.

McGraw-Hill Book Co., Inc., 330 W. 42nd St., N. Y. C.
Send me Croft's American Electricians' Handbook for 10 days examination on approval. In 10 days I will send \$5.00, plus five cents postage, or return book postpaid. (Postage paid on cash orders; same return privilege.)

Name _____

Address _____

City and State _____

Position _____

Company _____

EC. 6-43

In the News

[FROM PAGE 155]

agencies. In furnishing information about idle equipment, the Unit put prospective buyers in touch with owners of 3,302 items, aggregating 164,964 hp.

The idle motors and generators placed in active service through the efforts of the Idle Motor Unit represented a direct saving in materials and manpower. The manufacture of an equivalent amount of new equipment would have used 400 tons of critical materials and approximately 40,000 man hours. Moreover, production was speeded up, since the idle used motors and generators were supplied within a few days whereas it would have taken weeks or even months to obtain delivery on new equipment.

COMING MEETINGS

Illuminating Engineering Society—Great Lakes Regional Conference, Rackham Memorial Bldg., Detroit, Michigan, June 5. Northeastern Regional Conference, Shelton Hotel, New York, N. Y., June 11.

American Institute of Electrical Engineers—National Technical Meeting, Hotel Cleveland, Cleveland, Ohio, June 21-25.

International Association of Electrical Inspectors—Northwestern Section, Seattle, Wash., New Washington Hotel, August 26 and 27. Southwestern Section, Los Angeles, Calif., Mayfair Hotel, Week of August 30. Western Section, Chicago, Ill., LaSalle Hotel, September 13-15. Eastern Section, New York, N. Y., Week of September 20. Southern Section, New Orleans, La., Roosevelt Hotel, September 27-29.

EMERGENCY FARM WIRING REGULATIONS

Electrical inspectors and contractors present at the recent Electrical War Conference of the North Central Electrical Industries in Minneapolis were presented with a War Emergency Supplement to the 1940 edition of the Minnesota Farmstead Wiring Regulations. Compliance with the supplement alone will provide neither a complete nor an adequate electrical installation, as it is designed only for electric service for essential uses, including some necessary lighting.

Special emphasis was placed on the limitations of this emergency wiring and the hazards accompanying the addition of circuits by untrained persons. Effective during the critical shortage of materials or until revoked or superseded by action of the State Board of Electricity and the Farmstead Wiring Committee, the Emergency Regulations briefly cover the following phases of farm wiring:

General—Copper limitations preclude wiring farm residences up to usual standards. Where partial wiring is essential, it should be designed to eliminate need for makeshift wiring arrangements and the following requirements should be provided for in the order named:

1. Provide for a 20-amp. appliance circuit with at least two outlets.
 2. Ceiling lights, with or without switches are recommended for kitchen and dining room.

3. Receptacle outlets in living room and one bedroom as per MFWR, if any wiring is to be installed in these rooms.

4. At least one receptacle outlet in each other room to be wired.

5. Ceiling lights to extent that need and available material justifies.

6. Partial installation of wiring installation to be approved for "duration of war" when consistent with above recommendations.

Range Circuit—Number 8 wire permitted if rating of range does not exceed 12 kilowatts.

Pigtails—Code now permits 4-inches instead of 6-inches of free conductor at each outlet.

Boxes—Porcelain or non-metallic outlet boxes strongly urged for non-metallic wiring systems; mandatory when present stock of metal boxes is exhausted.

Substitutions—recommended or permissible as per N.E.C. Supplement.

Branch Circuits—Dwelling, if wired, must have minimum of one appliance branch circuit and provision for at least one lighting branch circuit.

Services—Neutral conductors of 3-wire feeders or services only between and in buildings may be one size smaller than the ungrounded conductors. Emergency rating of weatherproof wire in free air is given in following table.

MFWR Emergency Table E-1

Conductor Guage	Permissible Load Rating, Amps.	Rating Amps.
14	30	23
12	39	30
10	54	40
8	71	53
6	98	70
4	130	90
2	176	125

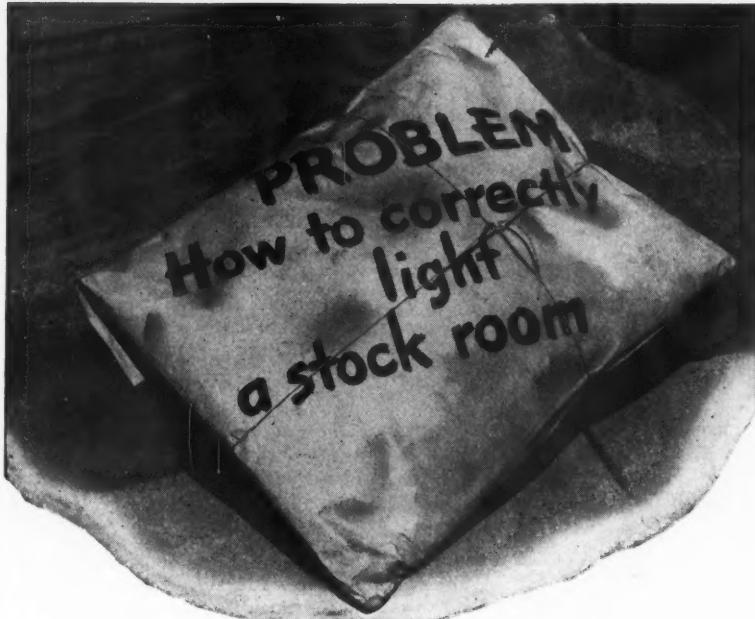
The following table gives the maximum lengths in feet for runs of the various size conductors under emergency conditions:

MFWR Emergency Table E-2

Wire Size AWG	3	6	10	15	20	36	50	Length of run in feet
12	220	110	66	44	33	
10	352	176	105	70	53	
8	550	280	168	112	84	48	...	
6	890	445	266	178	133	76	53	
4	...	707	444	282	222	121	85	
2	...	676	454	338	192	135		

Note: For 230-volt, 2-wire circuits or 115-volt, 3-wire circuits, double the distances indicated in the above table.

Where Service Entrance Cable or Conduit is not available for building services, open wiring may be run within the hollow spaces of a building wall provided such wires are fully enclosed in loom and not subject to excessive moisture and the wires terminate in or through approved fittings and enclosures.



WE FOUND IT ON OUR DOORSTEP

For years, it was kicked around—this "impossible" problem of properly illuminating shelves and bins in narrow stock room aisles. Finally, it was left with us.

Goodrich illuminating engineers designed a fixture to do the job by:

1. Providing uniform illumination of shelves from top to bottom row.
2. Obtaining higher intensities of light in bin interiors.
3. Eliminating eye-straining glare in the aisles.

These are the qualities that assure comfortable vision and enable you to do a better job easier.

Today, the Goodrich Stocklite is serving America at war—saving time in vital stock rooms, tool cribs, warehouses and Government Departments with faster, more accurate vision. Better stock room illumination can help you. Write for Bulletin 91.



Protecting vital plants with floodlighting—saving man-hours in production—Goodrich industrial fixtures are serving America's war effort everywhere.

LIGHTING FOR INDUSTRY

GOODRICH
ELECTRIC COMPANY
OFFICES IN ALL PRINCIPAL CITIES

GENERAL OFFICES AND FACTORY: 4602 BELLE PLAINE AVENUE, CHICAGO, ILL.
SOLD ONLY THROUGH ELECTRICAL WHOLESALERS

In the News

[FROM PAGE 157]



Building for Uncle Sam today so that we can build for you tomorrow.

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Your Copy of this Informative and Easy to Read Booklet About the Home of Tomorrow

• Don Herold, one of America's foremost writers and cartoonists, discusses an important phase of tomorrow's new homes.

This booklet is now being mailed to thousands of prospective builders all over the U. S. who have requested it in response to national advertising.

Mr. Herold's entertaining and enlightening outline of future home ventilation is must reading for everyone with an interest in residential construction. Write today for your free copy. Address: Dept. 1B-634, 2950 Robertson Road, Cincinnati, Ohio.

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Our organization is equipped to design and produce any Uptegraff Transformer without delay.

TRANSFORMERS



Uptegraff type AD Non-Inflammable Distribution Transformer with socket-mounted bushings.



Uptegraff type CSP Completely Self-Protected Distribution Transformer.



Type E, entirely enclosed; for indoor or outdoor; up to 5 KVA.



DRY TYPE

To change secondary power voltages to other voltages, and where oil for cooling is not allowed.



Send us your inquiries and ask for Bulletins.

R.E. UPTEGRAFF Manufacturing Co.
COTTDALE PENNA.-U.S.A.



M. W. FLYNN, Flynn Electric Co., Council Bluffs, Iowa, finds that joint ventures work well. "Marty" teamed up with Schultz Electric Co. of Council Bluffs to do the barracks job at the WAAC camp in Des Moines and is handling other contracts in a similar manner.

conductor in all wiring methods. Switch loops must employ Code Grade, EI, SB, or other approved insulation for all ungrounded conductors.

Conduit and Metal Raceways—are limited in use under WPB Regulation L-225.

Conductor Capacity—should be taken from the 1937 N.E.C. Table for Code Grade and Type EI wire. (See Table on page 44S of April 1, 1943 Supplement to the 1940 N.E.C.—Interim Amendment No. 41 to Section 3004.)

POSTWAR PLANS BY CANADIAN ASSOCIATION

Postwar planning was the keynote of the 11th annual dinner meeting of the Vancouver Electrical Association. W. C. Mainwaring of the B. C. Electric Railway Company and president of the Canadian Electrical Association was the main speaker. He stated that the entire program of the convention of the association this year will be devoted to postwar problems in the hope that a unified plan can be developed throughout the industry contending with conditions which undoubtedly will arise after this war, unless preliminary action is taken to prevent it. It is imperative, he said, that we realize the need to take action now, to forestall and eradicate the development of these problems which are bound to be ushered in with the coming postwar era.

Officers elected at the meeting were: C. Longley, president; R. Beaumont, vice president; J. S. Homershaw, secretary and R. Sutherland, treasurer.

Priorities

RESTRICTIONS ON CONSTRUCTION ARE EASED

Restrictions on war-time civilian construction were eased slightly in certain "minor construction" categories by an amendment of Conservation Order L-41, which controls civilian building operations.

The principal change brought about by the amendment is that which broadens the types of projects not restricted by the Order. Formerly, certain minor construction, defined by dollar limits, was unrestricted if no priority assistance was needed for obtaining material. The new amendment retains the dollar limitations but removes from the restrictions of the Order this minor construction regardless of whether or not priority assistance is required, provided no materials are used for utility connections. Authorization for this latter use of material is provided under orders in the U series.

Where priority assistance is needed for minor construction, the applicant must use either a PD-200, a PD-200-c, or a PD-105 form. This is necessary as a matter of

Smooth-walled IRV-O-LITE XTE-30 Extruded Plastic Tubing slips over meter element leads of aircraft temperature indicators. Two colors of IRV-O-LITE are used to identify the leads.

Soldering meter-element leads insulated with IRV-O-LITE into the complete circuit. The rigidly mounted electric iron simplifies this soldering operation.

- IRV-O-LITE insulated leads solder successfully!
- IRV-O-LITE resists high altitude cold!

In their temperature indicators for aircraft use, Thomas A. Edison, Inc., required an insulation that would meet their low temperature requirements and yet withstand soldering temperatures. Of equal importance, the tubing had to be flexible and thin-walled to resist sharp bends and create as little bulk as possible. These qualities, of course, were in addition to the necessary high dielectric and tensile strength requirements.

Because IRV-O-LITE XTE-30 meets all of these specifications, Thomas A. Edison, Inc. chose it for the job.

Other desirable properties of IRV-O-LITE include resistance to concentrated acids and alkalies—denatured alcohol—petroleum solvents, including gasoline—and most coal tar solvents. It does not support combustion.

Excellent insulation over a wide range of temperatures—flexibility—elasticity—resistance to moisture, etc., are only a few of the many reasons why IRV-O-LITE Extruded Plastic Tubing is gaining ever-greater acceptance by electrical manufacturers.

Here are some data on XTE-30 for a quick check against your requirements:

Dry Dielectric Strength	750 VPM
Tensile Strength Lbs. per Sq. In.	2,150
Resistance to Brittleness at Low temperatures:	
Standard Wall XTE Tubing did not shatter when slowly pinched with pliers at	—40 deg. F.
Life at 105 deg. C.	400 hrs.
Sizes, ranging from A.S.T.M. No. 24 to 1½" I.D.	
Colors (opaque) black, green, white, yellow, red and blue.	

For applications where higher dielectric and tensile strengths are required, and higher temperatures encountered, another type known as IRV-O-LITE XTE-130, is available. Further information may be had by sending for Product Information Bulletin No. FB-10. Write Dept. 96.

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G-E DEVICES

For Control of Power and Lighting Circuits



G-E LAMPHOLDERS

For Industrial Lighting Used in War Service



HIGH QUALITY G-E WIRING DEVICE



*Send
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FOR

BROADSIDE ON G-E WIRING DEVICES for Wartime Maintenance

You'll find wiring devices illustrated in this broadside that will fill needs on maintenance work you are handling. There are G-E Wiring Devices for practically every wartime industrial maintenance requirement. Shown in the broadside are many G-E power outlets, control devices, protective devices, fluorescent devices, lampholders, etc.

G-E Wiring Devices are high quality and will give dependable service. They are ideal for maintenance replacements, for additional wiring and for new war wiring systems. They are available in accordance with WPB limitation orders for projects rated A-1-J or better.

SEND →
THE COUPON
For Your Copy
of the G-E
Maintenance
Wiring Device
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General Electric Co.
Section D632-8
Appliance and Merchandise Dept.
Bridgeport, Conn.

Sirs: Please send me a copy of the G-E Maintenance Wiring Device Broadside.

Name.....

Address.....

City..... State.....

GENERAL **ELECTRIC**

In the News

[FROM PAGE 159]

administrative policy so that the War Production Board may examine the project as a whole and not in small segments as would be the case if PD-1A forms were used.

Preference ratings for various minor construction jobs are automatically assigned under certain blanket preference rating orders such as CMP Regulation No. 5 and Preference Rating Order P-144. Where applicants come under these regulations, they need file no other application.

Minor construction referred to in the amendment is that which fits into one of the following categories:

1. Residential construction and not multiple residential, or that which is listed in a group of special projects, and the estimated cost of construction is less than \$200.

2. Multiple residential, agricultural or other restricted construction, which is not listed in the group of special projects, and the estimated cost of construction is less than \$1,000.

3. Industrial construction, not listed on the group of special projects, where the estimated cost of construction is less than \$5,000.

4. The minimum construction necessary to make safe and to protect any structure, or its contents, damaged or destroyed by fire, flood, tornado, or other disaster.

5. Agricultural construction necessary to avert threatened loss of farm products.

The list of special projects includes those whose principal function is public or private amusement; occupancy by not more than five establishments selling or dispensing goods, merchandise, food or drink, or providing services; use as a club, lodge, fraternity or sorority houses, auditorium or assembly hall; or for the manufacture, processing, or assembling certain types of goods.

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INGENIOUS adaptation of existing machinery to do special work enabled Bernhardt Stabner, Industrial Electrical Works, Omaha, Neb., motor shop, to turn his entire machine shop over to war production. A clever home made double spindle milling machine for special job was his own contribution to the shop equipment.

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MOTOR SERVICE is the specialty of A. V. Rhine, secretary-treasurer of the Armature and Electric Machine Co., Omaha, Nebraska.

REPAIR PARTS FOR ELECTRIC FURNACES NOT AFFECTED

Controls on production and sale of foundry equipment and electric metal melting furnaces are established by General Preference Order E-11.

The new order covers foundry equipment of the types specified in Schedule A attached to the order and having a retail sales price of \$200 or over and electric metal melting furnaces as defined in the order. It provides that on and after June 1, 1943, no person shall sell, transfer or deliver any foundry equipment or electric metal melting furnaces except on orders bearing a preference rating of AA-4 or higher; nor shall such equipment be purchased by the application of any preference rating on Forms PD-25A, 25F, or CMP Regulation No. 5 or 5a.

All producers of foundry equipment and electric metal melting furnaces are affected by the order. It does not, however, prevent the sale and delivery of any part manufactured for use in the repair or maintenance of such equipment.

HAND TOOLS

Control of production and distribution of certain light power-driven tools has been modified slightly by WPB in an amended version of Limitation Order L-237.

Among the changes made are the following:

The amended order makes it clear that all light power-driven tools are covered by L-237, including electric, belt, pneumatic or hydraulic driven tools.

The purchase or delivery of light power-driven tools on ratings assigned by a PRP certificate or applied pursuant to CMP Regulation No. 5 or 5A is not permitted by the amended order. This provision, however, does not apply to deliveries of items which had a producer's list price on October 15, 1942, of \$175, or



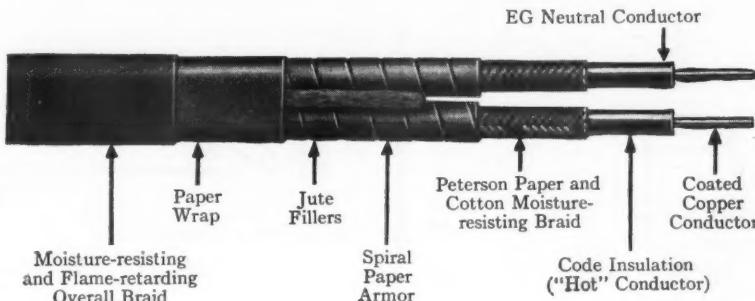
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G-E BRAIDX

(Non-metallic Sheathed Cable)

FOR POWER DISTRIBUTION

on Maintenance, Conversion and New Wiring Jobs



This sturdy non-metallic sheathed cable—with moisture-resisting and flame-retarding braid—will provide dependable power distribution for wartime requirements. Use it instead of rigid conduit or EMT wiring or BX **except in hazardous or wet locations**. You'll find it ideal for maintenance wiring, conversion wiring or new wiring.

G-E Braidx, 2- or 3-conductor, is available in sizes 14 to 4. It is carefully made of the finest materials. A complete line of boxes and fittings is available. G-E Braidx is approved by the Underwriters' Laboratories.

For further information see the nearest G-E Merchandise Distributor or write to Section C633-8, Appliance and Merchandise Dept., General Electric Company, Bridgeport, Conn.

GENERAL  **ELECTRIC**

The
SPEEDY

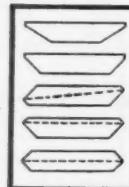
ARMATURE SLOT WEDGE OR KEY BEVELER



Weight
60 pounds

OFFERS YOU RAPID, ACCURATE SAWING AND BEVELING OF WEDGES OR KEYS USED TO RETAIN COIL WINDINGS IN THE CORE SLOTS!

- Cuts any Bevel
- Saws any Width



Edge bevels of any angle can be made by a simple change of cutting tools—takes less than a minute. Any combination of edge bevels can be made. Special saws for wedge material are furnished for cutting to proper width at no additional cost.

FOR MOTOR REPAIR AND PRODUCTION BEVELING

Using fibre, bakelite, wood or any other insulating material the Speedy Beveler speeds repair work and manufacturer beveling operations from 50% up to 500%, by user testimonials. Eliminates cost of ready made wedges—can be operated by any shop employee. Adjusts to any width or thickness.

DIVERSIFIED BEVELING OPERATIONS

Now in use by prominent war plants for other beveling operations on copper, aluminum, brass and other non-ferrous materials in accomplishing high speed beveling production.

Operates best with 1/3 H.P. motor

For Complete MAIL THIS COUPON
Data

**YOUNGSTOWN SERVICE
PRODUCTS CO., INC.**
YOUNGSTOWN OHIO

Gentlemen:

Please send me detailed information covering the SPEEDY ARMATURE SLOT WEDGE OR KEY BEVELER

Name

Company

Address

City State

In the News

[FROM PAGE 161]

less, an increase from the original limit of \$35. It also does not apply to deliveries by producers on purchase orders received prior to May 3, 1943, which have been rated pursuant to CMP Regulation No. 5 or 5A.

PD-1A HANDLED NOW BY FIELD OFFICES

In line with its policy of decentralization, WPB has raised the dollar limit of PD-1A applications processed in the field from \$100 to \$500, effective May 8.

Beginning May 8, all PD-1A applications involving not more than \$500 worth of material on which priority assistance is requested have been processed in either the District or Regional Offices according to the direction of the respective Regional Directors, except where specifically otherwise directed by the Director of the Distribution Bureau.

In all other cases, PD-1A applications have been forwarded by each field office to Washington, D. C., for routing in accordance with the regular procedure for processing such forms in Washington.

The new order means that now more than eighty percent of all PD-1A applications will be handled entirely by the field offices.

—WITH THE
Manufacturers

Westinghouse Changes

Appointment of A. J. Bronold as assistant to vice-president of the Westinghouse Electric and Manufacturing Company, was recently announced. Mr. Bronold, who has been manager of the Company's Los Angeles office since March 1941, will make his headquarters in Pittsburgh.

Succeeding Mr. Bronold as Los Angeles manager is Walter G. Willson, for the past 18 years Westinghouse manager at Phoenix, Ariz.

J. R. Fulton has been named assistant to the manager of the Industrial Department. He was formerly manager of the Company's Marine Section.

Charles A. Butcher, formerly assistant to the national manager of the company's District Manufacturing and Repair Department, has been named manager of that department for the entire Pacific Coast District of Westinghouse. Mr. Butcher will succeed R. E. Powers, who has resigned.

Frank H. Robb, formerly of Springfield, Mass., has been named manager of the Manufacturing and Repair Department for the Los Angeles area.

To Help You Plan and Estimate Wiring Installations

AUSTIN OFFERS

OUTLET BOXES
SWITCH BOXES
BAR HANGERS
LINE-O-LETS
BOX CONNECTORS
HEAVY WALL CONDUIT FITTINGS
THIN WALL CONDUIT FITTINGS
BUSHINGS AND LOCKNUTS
CONDUIT AND CABLE STRAPS
R E A FITTINGS
TOOLS
LUGS
NIPPLES
WIRES AND CABLES
ARMORED CABLE
THIN WALL CONDUIT
HEAVY WALL CONDUIT

These are just some of the items shown in our new 1942 144-page catalog. It is full of useful information and contains hundreds of illustrations that will be most helpful to you. Send for your copy today —ask for Catalog No. CF17.

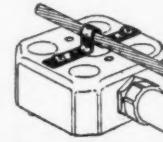
THE M. B. AUSTIN COMPANY
110 S. DESPLAINES ST. CHICAGO



New Practical Unit to Cut Installation Time

• The "Messenger Hanger" and the "Messenger Strap" fill the need for an economical, practical, time-saving unit for use with the new messenger cable type of installation. Mechanically strong, durable, lightweight. They have removable material and are easily and quickly installed. Our bulletin gives full and complete details—send for it.

See your Jobber.



"Messenger Hanger" for
Outlet Boxes
Straps made of Cadmium Plated Steel
Or Electroplated Steel
Top loop of hanger
grabs messenger
so that messenger
cannot come to be
put in place without falling off.

"Messenger Strap" for
Outlet Boxes
For Cadmium Plated Steel
Or Electroplated Steel
cable installation to
be used with Mineralac
messenger cable.
fits all standard outlet
boxes and 1/2" messenger
cable.

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ELECTRIC COMPANY
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P A R T S

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MOTORS • FANS CONTROLLERS

Authorized Distributors of parts for General Electric Co. — Robbins & Myers — Leland — Marathon — Master — Delco — Emerson — Hamilton Beach — Hunter — Century — Wagner — Ilg — Chicago Electric — Waring — Proctor — Thor — Peerless — Vaculator — Westinghouse — Allen Bradley — Cutler Hammer.

WINDING MATERIALS & REPAIR SHOP SUPPLIES

Write for Catalogue

READING ELECTRIC COMPANY, INC.
200 William St. New York, N. Y.

Electrical Contracting, June 1943

NEMA Honors Pioneers

At the Spring Meeting luncheon of the National Electrical Manufacturers Association in Chicago, Fifty Year Certificates were presented to three NEMA members. Max McGraw, president of NEMA

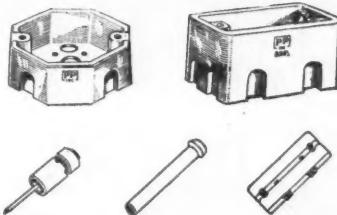
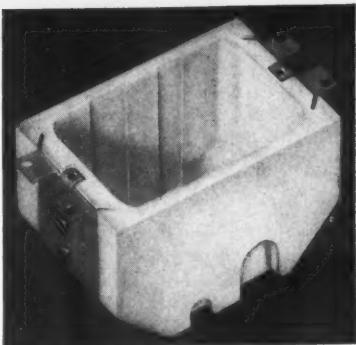


ADAM



KING

read the citations and presented the certificates to Fred B. Adam, president, Frank Adam Electric Co., St. Louis, Mo.; Charles E. Brown, executive vice-president, The Okonite Co., Chicago, Ill., and Charles K. King, president, Ohio Brass Co., Mansfield, Ohio.



United States Rubber Company, New York, announces the appointment of C. W. Higbee as manager of the newly organized wire and cable department. He has been with the U. S. Rubber Company since 1919, starting in the company's wire sales department at Bristol, R. I., where he later became factory superintendent. Subsequently he was assistant manager and then manager of wire sales.



HIGBEE

•

Sylvania Appointments

Announcement has been made of the appointment of F. J. Healy to the position of vice-president in charge of operations of the Sylvania Electric Products, Inc. He was formerly vice-president in charge of the lighting division. In his new post he will be responsible for all manufacturing operations in both the lighting and radio tube divisions of the corporation.



HEALY

Chester F. Horne, manager of operations at the fixture and appliance plants in Massachusetts, has been named general manager of the lighting division, replacing Mr. Healy.

A new sales office has been opened in the Lincoln-Liberty Building at Broad and Chestnut Streets, Philadelphia. This Division embraces Metropolitan Philadelphia, Eastern Pennsylvania, Delaware and adjoining sections of New Jersey.

Porcelain Meets WAR HOUSING Requirements for Non-Critical Wir- ing Materials

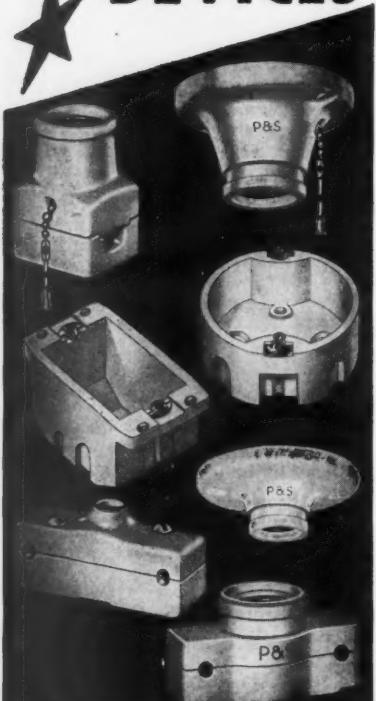
The War Housing Critical List, the Critical Materials Design Guide, the List of Prohibited Items for Construction Work, War Department Specifications—all require the use of non-metallic, or PORCELAIN Outlet Boxes and non-metallic type, or Knob and Tube Wiring Construction.

You can speed installation of every wiring job by using Porcelain Products' Porcelain Outlet Boxes, Surflets, Knobs, Tubes, Cleats and other non-metallic wiring materials.

Write for your FREE copy of Installation Manual on Porcelain Protected Wiring Systems.

PORCELAIN PRODUCTS, INC.
FINDLAY, OHIO

P&S (time-tested) PORCELAIN Wiring DEVICES



Just as P&S PORCELAIN WIRING DEVICES installed years ago are still serving faithfully—so new installations of these devices will serve long after this war is won.

Ask for complete information.

Sold through Electrical Wholesalers

PASS & SEYMOUR
INCORPORATED
SYRACUSE, N.Y.

In the News

[FROM PAGE 163]

Okonite Election

At a recent meeting of the Board of Directors of the Okonite Company, Passaic, N. J., E. D. Youmans was elected vice-president and technical director. He was also elected to the same position in the Okonite-Callender Cable Co., Inc., of Paterson, N. J.

The Okonite Company has established a new district sales office in 904 Pere Marquette Building, New Orleans, La. This office is in charge of W. D. Stroud, sales engineer, formerly of the Birmingham office. The territory of the new district sales office will include Louisiana, Southern Mississippi and Northwest Florida.

The Artkraft Sign Company of Lima, Ohio, has announced that their product is now also available through the manufacturing and distributing facilities of the Edwin F. Guth Company and the F. W. Wakefield Brass Company. The product of these companies will henceforth be known as the Guth-Artkraft Fixtures and Wakefield-Artkraft Fixtures.

Graybar Electric Company has named W. W. Castleberry as Service manager of the Jacksonville office. He was formerly acting service manager.

Thordarson Elections

At a recent meeting of the Board of Directors of the Thordarson Electric Manufacturing Company of Chicago, R. E. Onstad was elected president and general



INSPECTOR Ralph G. Ford of the electrical department, City of Omaha, Nebraska keeps in touch with local Contractor activities. He is also secretary-treasurer of the Master Electrical Contractors Association of Omaha, Nebraska and Council Bluffs, Iowa.

TOPS
IN
TIME
SWITCH
QUALITY

for only \$13.00 LIST . . .



The Paragon 300 Series includes ALL the essential features of truly top quality time switches . . . yet the list price is only \$13.00. Some of the features are: only 2 exposed gears, all others operate in a sealed oil-filled chamber; slow speed motor; sturdy clock train; snap-action switch; simple hand trip; attractive modern case; 2000% more dial power than required. Satisfactory service, workmanship and material guaranteed. Send for complete bulletin.

PARAGON ELECTRIC COMPANY

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BUILDERS OF ELECTRICAL EQUIPMENT . . . SINCE 1901

Safe-T-Glow

HIGH TENSION DETECTOR



SAFETY RULES call for that EXTRA precaution and additional RE-CHECK which SAFE-T-GLOW provides. Detects accidental tie-ins, crossovers, leakages and induced voltages . . . prevents serious injury and loss of life. SAFE-T-GLOW consists of a sensitive Neon tube, amplified by mirror reflector.

Model A for circuits 2,000 to 35,000 volts.
Model B for circuits from 35,000 to 220,000 volts.

TEST-O-LITE

Tests Everything Electrical from 100 to 550 Volts

Equipped with Neon light which tells instantly where trouble lies in circuits, fuses, cut-outs, motors, etc. Indicates hot or grounded wires. Tells AC from DC. SAVES PRECIOUS TIME. Has PATENTED safety features. Vest pocket size with clip. Lifetime guarantee. List Price \$1.50 at leading jobbers.

L. S. BRACH Mfg. Corp.
55-63 Dickerson St. Newark, N.J.

manager, following the resignation of C. H. Thordarson as president. Mr. Thordarson, who founded the company nearly a half century ago, will continue as technical consultant.

L. G. Winney, formerly treasurer was named vice-president and treasurer and W. R. Mahoney, formerly connected with Arthur Anderson and Company, was elected assistant treasurer.

More Gossip —

Elected for Duration

Taking a somewhat unorthodox step, as associations go, the Master Electrical Contractors Association of Omaha, Neb., and Council Bluffs, Iowa, have elected their officers for the duration.

Members, all from Omaha, chosen to guide the Association throughout the war are: president, Sam Dodson, Dodson Electric Co.; vice-president, Ed Bradley, Bradley Electric Co.; secretary-treasurer, Ralph G. Ford, city electrical inspector of Omaha.



HOUSING EXPERT, Irving Clark, Chairman, Housing Committee, Westinghouse Electric and Mfg. Co., told E.E.I. delegates at a Chicago postwar symposium that the 1940-1950 decade will be the first housing peak the electrical industry ever experienced.

War Weeds Out

The war and all its ramifications is rapidly taking its toll in the electrical contracting industry in Indianapolis. New construction of war plants has about reached the saturation point and the smaller contractors, seeing the light, are turning to other fields — primarily maintenance work.

A conservative estimate places about 50 percent of Indianapolis' electrical contractors in defense plants. A few are working for larger contractors who are still doing construction work. Chances are that more of them will swing to maintenance before long.

QUALITY . . . SERVICE PERFORMANCE . . .

Conservation restrictions controlling the use of copper, rubber and other scarce materials affect production of all Simplex wires and cables. Today we cannot put some of the desirable ingredients into our insulation as freely as we could only a short time ago but our study of their use in cable insulation and our records of their effect on cable performance enable us to get the best possible results with the limited quantities that we are now permitted to have.

The serviceability of Simplex wires and cables has been maintained at a high level but priority regulations restrict their manufacture to orders for essential war work. Production of wires and cables for commercial use has been almost entirely eliminated. Cables can be bought only for service having high priority rating.

If you must have new cables for such work it will be well worth-while to bear in mind that Simplex trade names have stood for quality, service and performance for over half a century. They still represent a product based on years of experience and, although modified in some respects to meet war conditions, they still assure satisfactory performance.

Simplex

WIRES AND CABLES

ANHYDREX Submarine cables insulated with deproteinized non-water absorptive rubber.

ANHYDREX-X Underground cable that needs no steel tapes, lead sheaths or other protection.

CAOUTCHOUCE (B.C.) — a rubber covered braided building wire with 30% rubber insulation.

CONDEX cable protected with overlapping, interlocking flexible steel conduit.

FIBREX* Tree Wire for power line installation among trees or where chafing of the line may occur.

LATOX* cables insulated with the new rubber insulation made directly from prevulcanized latex.

LATOX-X cords with rubber insulation on the conductors and with a sheath made from prevulcanized latex.

PLASTEX wires and cables with flameproof, ozoneproof, acid, oil and alkali-proof, low voltage insulation.

SIMCORE — a building wire that meets the Underwriters' Laboratories requirements.

SIMPLEX Power cables with varnished cambric or impregnated paper insulation.

TELEX Underground Telephone Wire that is laid without conduit.

TIREX Rubber jacketed cables for portable machines where rough service is imposed on the cables.

TIREX rubber jacketed cords for portable electrical tools and appliances.

*Discontinued for the duration of the war.

Simplex WIRES and CABLES

Simplex Wire & Cable Co., 79 Sidney Street, Cambridge, Mass.



RESISTORS IN THE AIR

In the new Bendix RTA-1B two-way telephone for aircraft ground station service, WARD LEONARD, wire wound vitreous enamel resistors are used. They were selected because of their proven dependability under all conditions.

Ward Leonard Engineers are at the service of every manufacturer of equipment using resistors. They will gladly suggest the resistor from the Ward Leonard line that will not only give you the best possible service but will be best adapted for the conditions of assembly.



RESISTORS

withstand heat, moisture, vibration and other adverse conditions. They cover a wide range of types, sizes, ratings, terminals, mountings and enclosures. Write for bulletins.



WARD LEONARD

RELAYS • RESISTORS • RHEOSTATS

Electric control devices since 1892.

WARD LEONARD ELECTRIC COMPANY, 28 South St., Mount Vernon, New York

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SPEER**

CARBON,
GRAPHITE
AND METAL
GRAPHITE

BRUSHES

for Motors and Generators



● In addition to MUL-TIFLEX BRUSHES for improved communication, more uniform wear and lower performance costs and TRANSERT BRUSHES for even current distribution, better ring lubrication and longer life, we can supply any Carbon product—such as contacts for circuit breakers, etc.

● Write today and let us give you complete details on this line—learn all of the benefits you can realize through our product quality and our specialization.

HELWIG CO.
2548 N. 30TH STREET
MILWAUKEE, WISCONSIN

MARTIN VISE STAND

AND

PIPE BENDER



Large Stand Set Up

PORTABLE . . .

Saves time on cutting and threading conduit

Non-skid—non-slip—sets up in half minute and stands without hitching. A genuine time saver for cutting and threading conduit up to 2½". Bend capacity ¾". Carry this MARTIN stand right on to the job with you. Folds compactly in 30 seconds. Large size handles conduit to 4½". Write for more facts or see your wholesaler.

H. P. MARTIN & SONS

800 W. 12th St.

OWENSBORO,

KENTUCKY

**There's more profit in
MOTOR REWINDING jobs
when these quick, accurate
methods are used . . .**

Just Published—Up-to-date 2nd Edition

REWINDING DATA

for Direct-Current Armatures

By G. A. VAN BRUNT and A. C. ROE.

Revised, enlarged Second Edition, 277 pages, 6 x 9, 199 illustrations, \$2.50

Here is a clear, concise, and practical manual for every electrical repair shop, showing how to rewind d.c. armatures of every type, and giving descriptions, instructions, and data that may be referred to constantly for help in speeding up the work and assuring satisfactory results.

The book especially emphasizes what data to take when stripping armatures and forms for recording them correctly, to facilitate easy, rapid, accurate rewinding by any member of the shop. Also included is handy information on layout of various windings, insulation methods, and armature-finishing methods. Takes the repair man through all steps—except forming the coils—in rewinding any armature.

A few of the topics covered:

- forms for data on small, medium-sized, and large armatures
- winding rules for d.c. armatures
- rewinding armatures to prevent errors in rewinding and connecting
- finding the lead throw of armature coils
- winding and connecting data for some old d.c. armatures
- cutting out coils in d.c. armature windings
- synchronous-converter armature windings
- frug-leg windings for multipolar motors and generators
- slot and end insulation
- characteristics of glass fiber insulation
- application of glass insulation
- banding and dipping armatures
- baking with infra-red lamps
- modernizing old armature cores

McGraw-Hill Book Co., 330 W. 42 St., N.Y.C.

Send me Van Brunt and Roe's Rewinding Data for D.C. Armatures, for 10 days' examination on approval. In 10 days I will send \$2.50, plus few cents postage, or return book postpaid. (Postage paid on cash orders.)

Name

Address

City and State

Position

Company EC. 6-43

NEW

in this edition

- how to use glass insulation
- how to bake armatures by infra-red heat

Examine book

10 days free

SEND THIS COUPON

More Gossip

Cycling Electricians

We've heard about electricians on stilts and other novel ideas to speed up electrical construction work on war projects. But the Ernest Freeman and Company, Chicago electrical contracting firm puts its electricians on bicycles. No, it's not because of a gasoline or tire shortage, but to speed up supervision of the installation of an electrical system in a large war plant being built for plane production.

Foremen pedal from point to point to check up and see that all is progressing as scheduled. Bikes are equipped with a small basket or box for odds and ends and a set of plans fit nicely across the handle bars. The saving in man hours and incidentally precious shoe leather, is considerable. Anything goes when it's a question of speeding up the job.



HALF A CENTURY of service in the electrical industry is being celebrated this year by the Omaha Electrical Works, Omaha, Neb. William H. Guthrie, vice-president and Manager, is justly proud of that record.

On The Home and Fighting Fronts

Electrical contractors down Chattanooga way are busy these days on the home and fighting fronts. Since most of the group are beyond the fighting age, they are finding other ways of lending a helping hand.

The Lawson, Terrell, Teas, Cofer and Curtis electrical contracting firms are handling large projects directly related to the war effort. Their activities extend throughout five states—Tennessee, Georgia, Kentucky, Ohio and Oklahoma.

On the war housing front, the Stanley and Dobbins firms hold sway on two sizable projects for war workers.

H. B. Stanton has become the housewife's angel of mercy by specializing in the repair and maintenance of electrical heating devices.

War casualties, from the standpoint of business operation, are the Hennesse, Reeves and Case electrical firms, whose owners have closed their doors for the duration and gone into other branches of the

electrical construction field. Other contractors are maintaining service necessary to the upkeep of establishments on every day wartime business.

Four members of the contractor's group are now in the armed forces. Paul Clark, son of V. Clark, was recently awarded his wings in the Army Air Corps and is now stationed at Bering Field, Nashville, Tenn. Paul was formerly active in his dad's contracting business. Two other members in the army are Harvey Ashmore of the Central Neon and Electric Co., and Lt. Seagle Bender, former electric appliance manager for Fowler Brothers. Allied Electric Company's Frank Hasenkamp is now a lieutenant in the Naval Reserve.

Supervises Furnace Installation

L. A. Ragon, L. A. Ragon Electric Company, Chattanooga, Tenn., recently had the opportunity to play a part in the rehabilitation of idle equipment for war production. His services were retained by the Chattanooga Implement and Manufacturing Company to supervise the installation of an electric furnace that was dismantled in Ohio and shipped piecemeal to Chattanooga. The furnace which is basically of English design was acquired to produce steel for an ordnance item. The electrical equipment included furnace tilt motors, electrode level control motors, and control panels with meters and switches for furnace heat control.

C.E.A. Shop Group Elects

Harry J. Hennequin, Ridgewood Steel Company, was re-elected president of the Industrial and Commercial Division of the Cincinnati Electric Association at the recent annual meeting of that group. Selden F. High, Sullivan Electric Company, was re-elected vice-president and Edgar B. Conradi, Barkley Electric Company was chosen to be secretary and treasurer.



E. J. MICKA, Hibbing, Minn., electrical contractor, is the newest member of the State Board of Electricity having started a five year term of office in January. Ed is also president of the Minnesota Electrical Council.

...SPERO

A DEPENDABLE SOURCE For Industrial Electric Fittings and Lighting Equipment

Why waste time and lose orders by "shopping around"? Spero will back you up with prompt deliveries of quality electrical products—priced right. Spero line includes:

SPERO NOW MAKES NAVY 95 FITTINGS

To meet the demands for 95 Series fittings for the U. S. Navy, Spero now offers a complete line of steel drawn boxes—in 3", 4" and 5" sizes, manufactured according to Navy drawings.

- Fluorescent Lighting Fixtures
- Shallow and Dome Type Reflectors
- Flood Light Fixtures and Equipment
- Vapor-proof Lighting Units
- Surface Cabinets
- Industrial Installation Equipment

Distributed only through legitimate electrical wholesalers

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18222 LANKEEN AVE. ★ CLEVELAND, OHIO

ONAN

ELECTRIC PLANTS

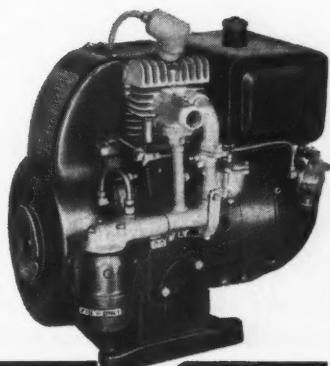
Doing a Winning Job in the War

Thousands of ONAN ELECTRIC PLANTS are supplying electric service for our Armed Forces all over the world. On land, sea or in the Air, in combat or defense, they are doing a winning job.

Available in sizes 350 to 35,000 watts, A.C. or D.C. also dual output; 50 to 800 cycle; 8 to 4000 volts; Gasoline driven; Air or water cooled.

LIGHT, COMPACT, STURDY

We'll be glad to furnish details on your present or post-war need for Electric Plants.



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Reprints of Digest of Wartime Electrical Maintenance Practice

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men in your organization—

The important 24-page summary of electrical maintenance organization, priorities and know how that is published complete in this issue is vital information for all men concerned with wartime electrical maintenance. Under paper limitations, we cannot publish enough extra complete issues to meet the demands of all who want copies for personal reference. Reprints of the Digest, however, are available from a limited supply. Please place your order now on the coupon below. Price 20 cents each.

**Reprint orders will be accepted
until JULY 15 . . .**

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330 West 42nd St., New York

Please send me copies of your 24 page reprint "Digest of Wartime Electrical Maintenance Practice".

Name.....

Address.....

More Gossip—

Contractors in Public Office

The Contractors' Division of the Electric League of Indianapolis, Indianapolis, Ind., during recent months witnessed two of its members move into a public office where their talents can be further expended in the interest of the people of Indianapolis.

H. W. Claffey, present chairman of the group and secretary of the League is serving in the House of Representatives of the State Legislature. Walter Meyers, ex-chairman of the division, has been appointed Chief Electrical Inspector of the City of Indianapolis. In his new position he is responsible for the electrical safety of all electrical installations in the city.



CHARLES B. FARRAH newly elected chairman of the Rocky Mountain Chapter, I.A.E.I., and **Victor C. Moulton** (right) president of the Western Section I.A.E.I. and secretary-treasurer of the Rocky Mountain Chapter, discussing one of the issues presented at the Inspectors Ninth Annual School.

C.E.A. Certified

The Cincinnati Electrical Association has again received a "Certificate of Approval" from the Committee on League Financing of the National Electrical Manufacturers Association. This yearly approval, the seventh consecutive one for the C.E.A., is granted to electrical leagues or associations only after submission of a detailed questionnaire covering their activities and promotions during the past year and a proposed budget for the present year. All of which proves that the C.E.A. is doing a good job.

Motor Keglers Compete

Competition among electric motor dealers and service shops extends to the lanes of Chicago's bowling emporiums. Electric Motor tops the Motor Dealers League with Hohman & Hill second and L. M. Stein a close third.

High individual scoring honors go to E.

SEARCHLIGHT SECTION

(Classified Advertising)

Employment Business

Equipment

(Used or Resale)

"OPPORTUNITIES"

UNDISPLAYED RATES

15 Cents a Word. Minimum Charge \$3.00. POSITION WANTED (full or part time individual salaried employment only), $\frac{1}{2}$ the above rates payable in advance.

BOX NUMBERS—Care of publication New York, Chicago or San Francisco offices count as 10 words. DISCOUNT OF 10% if full payment is made in advance for 4 consecutive insertions.

DISPLAYED RATE

INDIVIDUAL SPACES with border rules for prominent display of advertisements. The advertising rate is \$7.50 per inch for all advertising appearing other than a contract basis. Copy must be submitted on request. An ADVERTISING INCH is measured $\frac{1}{4}^{\prime\prime}$ vertically on one column, 3 columns—30 inches—to a page.

NEW ADVERTISEMENTS received by June 21st will appear in the July issue, subject to limitations of space available.



L. A. BARLEY veteran electrical inspector, whose retirement from active service was recognized by presentation of a ship's cloak by members of the Rocky Mountain Chapter, I.A.E.I. at the annual conference and Victor H. Tousley (right), field engineer, National Fire Protection Association, who attended the event.

Kappes of Electric Motor with a handicap average of 179, while Ther Electric's Dolejs and Zojicek are tied for second with 174 each. Nield of Ther has high game lead with a 298. T. Dominski of L. M. Stein, carries high series honors with a handicap score of 734.

C.E.A. Contractors
Pick '43 Slate

H. E. Gerboth was recently elected president of the Electrical Contractors Division of the Cincinnati Electrical Association. Other officers chosen to serve with him are: vice-president, P. W. Schath; secretary, J. F. Riehle; treasurer, A. J. Bader. Members of the Board of Directors are: A. L. Bang, E. W. Edmonds, Chas. Fisher, Fred Horstmann and A. Wottitz.

WE BUY & SELL
MOTORS
TRANSFORMERS
MOTOR GEN. SETS
OIL SWITCHES
AIR CIRCUIT BREAKERS

ELECTRIC EQUIPMENT CO.
578 Lake Ave., Rochester, N.Y.
Tel. Glenwood 6723

2 MOTOR GENERATOR SETS WESTINGHOUSE

37 H.P. Motor 220/440-3-60
Generator 25KW V118 A212

38.5 H.P. 220-3-60
Generator 30KW 125V A250

Complete with switches, starting compensators, regulators, instruments. Can be seen in operation. Also Westinghouse & Cut. Ham. charging units, cables, plugs, wiring.

HOLLAND LAUNDRY
1493 Hudson Blvd., Jersey City, N.J.

WANTED

WILL PURCHASE
Any quantity Fractional H-P Motors
—for Cash!

Fractional H-P Motors—Always in Stock!!

H. U. MANN
540 Lake Shore Dr. CHICAGO



NEW PRESIDENT of the Minnesota Electrical Association, Eric G. Nyland, Duluth, receives the congratulations of retiring president L. E. Shaffer, Pipestone, after officers were chosen at the recent session of the N.C.E.I. War Conference in Minneapolis. The Minnesota Electrical Association is an active group of electrical contractors from all parts of the state.

When
"KNOW-HOW"
is important

let
MILLER
do it!

The South's largest general electrical contractor offers you the experience gained from millions of dollars worth of successfully completed contracts for Army, Navy and civilian projects of all kinds including structural work and public utilities distribution systems.

Full equipment and engineering staff available to service any contract, regardless of size.

Miller Electric
Company
556 Riverside Ave.
Jacksonville, Florida



Marine Electrical Specialties



All types of electrical specialties, boxes, cabinets, control panels, duct-work, etc., manufactured by an organization accustomed to meeting exacting Army and Navy specifications. Full engineering personnel and equipment for manufacture of special electrical items in addition to all standard articles.

Write for information.

Jacksonville Metal Manufacturing Company
JACKSONVILLE, FLORIDA

MULTI INCANDESCENT REFLECTORS



**Approved by Contractor
Approved by Industry**

★ MULTI has always endeavored to supply the proper units to best fill given specifications—units that are practical, modern, and flexible to meet changing demands. This has earned the approval of both contractor and user. MULTI installations make good looking finished jobs for contractors with no after worries—they give users units that are easy to clean, economical to maintain, and that give good lighting over long periods at reasonable cost. Send for our complete catalog.

MULTI
ELECTRICAL MANUFACTURING CO.
1840 W. 14th St., CHICAGO, ILL.

The Stone You Can Bend and Twist



Flex-Stone

What a job FLEXSTONE does! Cuts like an abrasive stone—but you can bend, twist it. Won't break! Thin, non-brITTLE. Sharpest abrasives are pressed into flexible core. Easily fits tight places. Smooths hardest contact points in relays, cutouts—cleans small commutators, switches, etc. Non-conductor—no short circuit. Rimac FLEXSTONE speeds electrical service. Send for free sample!

RINCK-McILWAINE, Inc., 16 Hudson St., New York, N.Y.

**Test Insulation the Modern Way
with a MODEL B-5**

MEGOHMER

NEW BATTERY-VIBRATOR TYPE

No more tiresome cranking of a hand-driven generator . . . Entirely self-contained, steady test potential of 500 volts DC, available at the touch of a switch. Direct reading in insulation resistance.

HERMAN H. STICHT CO., INC.
27 PARK PLACE
NEW YORK, N.Y.

VARIOUS NEW MODELS
AND RANGES



WRITE FOR BULLETIN NO. 430 E

Shop Conversion to War Work

[FROM PAGE 53]

After the piece leaves the cutting table it goes to the boring machine, which is in reality a converted drill press. Here the 3½-inch hole burned in the 7 by 7 by 1½-inch metal block is bored out to 3¼-inch diameter. A special heavy jig (Fig. 4) designed for mounting on the drill press table incorporates a pillow block for the shaft extension for the boring tool and a smaller jig to center the work. Movement and vibration are eliminated and an accuracy of .002 inch is maintained.

Under another subcontract the shop

DON'T MUFF FASTENING JOBS USE PAINE IMPROVED CONDUIT CLAMPS

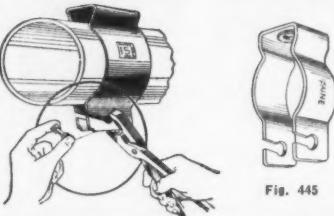


Fig. 445

For securely fastening ★ Conduit ★ Open Wiring ★ Cables ★ Thin Wall Tubing to Hollow and Solid Walls and Cellings with greater rapidity.

PATENTED SLOT makes installation faster, easier and better. Each box has correct Size Screw Bolts. Faster clamps with PAINE Machine Screw Lead Anchors to Concrete and Masonry and PAINE Toggle Bolts to Hollow Material.

Ask Your Supplier and Write for Catalog

THE PAINE CO.
2961 Carroll Ave. Chicago, Illinois
Offices in Principal Cities

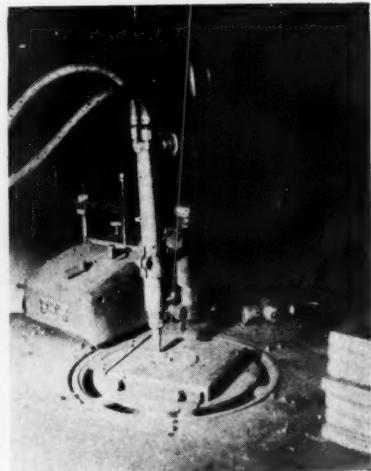


FIG. 6.—FLAME CUTTING of center hole is accomplished by a turntable fitted with a jig. Cutting machine is stationary. Flame burns continuously affecting a considerable saving in oxygen used.

was required to turn a 2½-inch metal disc with a 1-inch diameter shaft on each side, out of a solid piece of round stock. A novel jig (Fig. 5), mounted to the tool carriage of a 16-inch lathe makes this 1½-inch cut in one operation. The jig consists of a solid block of metal with an opening in the center large enough to accommodate the original stock. One side of this block is fitted with two cutting tools diametrically opposite each other. The cut is started at the right end of the shaft. The tool carriage is slowly moved to the left making the entire cut in one setting. A fitting in the top of the jig directs cutting oil over the work and a drip pan with a return hose catches the oil and metal shavings.

These are just a few of the many "tricks" that have made this motor shop into an efficient production unit while still maintaining its service.

Continuous form, triplicate invoices are now purchased in a long perforated strip with about 800 invoices to the pack. An attachment (the one illustrated is a product of the Hamilton Autographic Register Co.) which can easily be mounted to the carriage of any standard typewriter, holds the invoices and rolls of carbon paper that go between the sheets. The complete attachment telescopes into mounting posts fastened to the carriage and can be lifted off, freeing the machine for normal typing.

The attachment is so regulated that the invoices are perfectly aligned in the typewriter. After an invoice has been completed, it is pulled up and fastened to holding pegs and the carbon sheets rolled back by turning a geared hand wheel at the upper right of the mechanism. The carbons are now ready for the next set of invoices which are automatically set at the date line, requiring no further adjustment. The completed invoice is then torn off the strip and ready for mailing. Additional carbons can be made by inserting additional rolls of carbon paper and using additional strips of invoices.

The time saving feature of this system is obvious. A girl, without normal interruptions, can type more than 200 invoices per day. Approximately 30 sets of invoices can be made from one setting of the carbon paper. The used carbon is then torn off the roll and new carbon pulled up.

An added feature of this new invoice (Fig. 4) is the removable tab at the bottom, showing the breakdown of the invoice into wiring, merchandise, shop or other items. It is torn off the customers copies, but remains on the yellow office file copy, eliminating the necessity of keeping a master breakdown analysis sheet. The complete continuous invoice system, including the attachment and invoices is more economical than the former pad type, according to Mr. High.

Both of the office simplification methods discussed here are applicable to contractors as well as motor shops, since both have almost identical payroll and invoicing problems. A little thought will show that an outmoded office system can handicap a business enterprise. Clerical departments must be as progressive as the production end; both must be balanced and in step. Simplified office methods are one solution to overworked and understaffed office forces under present conditions.

WHERE TO BUY

Equipment, Materials and Supplies for Electrical Construction — Maintenance — Repairs



STAR TEST POCKET PLIERS
235 Canal St. New York, N. Y.

DRILLS CONCRETE—METAL—WOOD



WODACK "DO-ALL"
ELECTRIC HAMMER AND DRILL
Saves time and money installing expansion anchors. Drills concrete to 1½" dia.; metal to ¾". Two tools in one. Easy to maintain. Universal motor. Star drills in 17 diameters. Also chisels, bull points, etc. Write for bulletin.

Wodack Electric Tool Corporation
4628 W. Huron St. Chicago, Ill.
Telephone AUSTIN 9866

ELECTRIC MOTOR
PARTS
FOR ALL MAKES
One of the largest consolidated stocks of motor, fan and controller parts on the east coast.
Write for Catalogue
READING ELECTRIC CO.
INCORPORATED
200 William St. New York City



Make this test: Actual movie photo of test. Note clip's return to perfect form

LITTELFUSE BERYLLIUM COPPER FUSE CLIPS

LITTELFUSE Beryllium Copper FUSE CLIPS show spring qualities equal to steel. Other characteristics: High fatigue resistance and tensile strength. Grips fuses tighter. Write for Bulletin.

LITTELFUSE INC., 4789 Ravenswood Ave. Chicago, Ill.



The TORK CLOCK CO., Inc.
MOUNT VERNON, NEW YORK

This WHERE TO BUY Section

supplements other advertising in this issue with these additional announcements of products and services essential to efficient and economical operation, maintenance and service. Make a habit of checking this page, each issue.

Departmental Staff,
ELECTRICAL CONTRACTING

TRANSFER FROM NORMAL
TO EMERGENCY SERVICE



AND ALWAYS DEPENDABLE.
THAT'S PROVED RECORD OF

New Improved

ZENITH

Automatic Transfer Switch

Transfer in 1/25 second. Never "lets you down" where continuous lighting is absolutely necessary. Electrically held. All contacts on one shaft, operate in same direction, A.C. to A.C., A.C. to D.C. Any combination, 1, 2, 3, 4 poles. 18 capacities, 30 to 400 amps. Also made electrically operated, mechanically held.

Get Complete
Zenith
Catalog.

Magnetic Contactors, Time Switches, All Types Timers, Program Clocks, etc. Control equipment for special jobs.

ZENITH ELECTRIC CO.
155 W. WALTON ST., CHICAGO, ILL.



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32-pages of life-illustrations and descriptions of items you need right now.

Your guide to America's Finest
ELECTRICAL CONNECTORS
FABRICATED TUBE PARTS

MAIL THIS
COUPON
TODAY!

Please send details and new
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ILSCO COPPER TUBE & PRODUCTS, Inc.
CINCINNATI, OHIO

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Rain-tight Multi-breakers with a variety of circuit arrangements for such outdoor applications as lights, signs, etc. Also Multi-breakers and circuit breakers in weather and dust-tight and explosion-resisting enclosures.

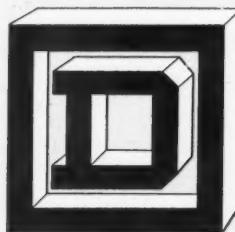


Industrial Circuit Breakers in standard sheet steel enclosures are available in capacities from 15 amperes to 600 amperes, up to 575 Volts. Made in 2 and 3 poles and for 3 and 4-wire systems. These devices are quick make and quick break with trip indication.



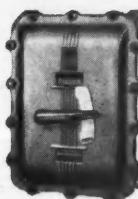
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If you have a problem which involves electrical control or distribution, you're welcome to the counsel of the nearest Square D Field Engineer. He is in constant contact with plants of every kind and size. He studies methods and applications with the idea of simplifying new jobs or doing old ones better.

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You'll like the high quality of G-E Electrical Metallic Tubing and G-E Flexible Metal Conduit. They are easy to use and will give good service. These materials can be used to protect war-purpose wiring in certain locations according to WPB Limitation Order L-225.

FOR FURTHER INFORMATION about G-E conduits, wires and cables and wiring devices see the nearest G-E Merchandise Distributor or write to Section CDW-531-8, Appliance and Merchandise Dept., General Electric Company, Bridgeport, Conn.

GENERAL ELECTRIC

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